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Readers are encouraged to examine the abstracts in each category of interest. If time is short, and when interest is concentrated in specific areas, readers may wish instead to scan source, author, and subject indexes. A more thorough coverage of a subject field may often be achieved by detailed examination of the subject listings, especially as they are cross-indexed in the quarterly indexes.

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Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **1794**

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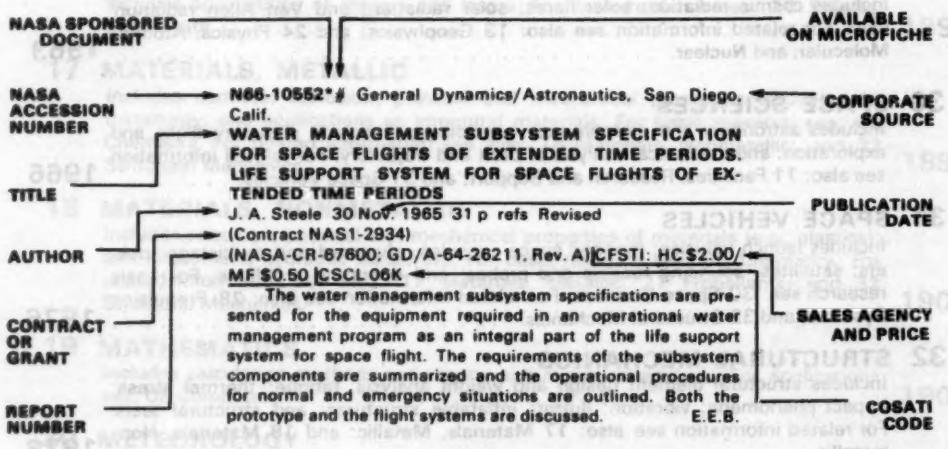
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N66-10552*# General Dynamics/Astronautics, San Diego, Calif.
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TITLE
WATER MANAGEMENT SUBSYSTEM SPECIFICATION FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS. LIFE SUPPORT SYSTEM FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS
PUBLICATION DATE
AUTHOR
J. A. Steele 30 Nov. 1965 31 p refs Revised
(Contract NAS1-2934)
(NASA-CR-67600; GD/A-64-26211, Rev. A) CFSTI: HC $2.00/MF $0.50 CSCL 06K
CONTRACT OR GRANT
The water management subsystem specifications are presented for the equipment required in an operational water management program as an integral part of the life support system for space flight. The requirements of the subsystem components are summarized and the operational procedures for normal and emergency situations are outlined. Both the prototype and the flight systems are discussed. E.E.B.
SALES AGENCY AND PRICE
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VOLUME 4 NUMBER 11

Scientific and Technical Aerospace Reports

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June 8, 1966

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N66-21137*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AERODYNAMIC CHARACTERISTICS OF VARIOUS CONFIGURATIONS OF A MODEL OF A 45° SWEPT-WING AIRPLANE AT A MACH NUMBER OF 2.01

M. Leroy Spearman, Cornelius Driver, and Ross B. Robinson Washington, NACA, 26 May 1965 41 p refs
(NASA-RM-L54J08) CFSTI: HC $2.00/MF $0.50 CSCL 01A
(Declassified)

An investigation of the aerodynamic characteristics in pitch and sideslip at a Mach number of 2.01 of a model of a 45° swept-wing fighter-type airplane configuration has been conducted in a supersonic pressure tunnel. During the course of the investigation, various modifications were made to the model to determine their effects upon its aerodynamic characteristics. These modifications included a lengthened body nose, a faired bump on the fuselage afterbody designed to improve the longitudinal area distribution, drooped inlets, and an extension to the wing tips that resulted in an increase in the aspect ratio of the wing from 3.2 to 3.7. Author

N66-21148# von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese. (Belgium).

SUPERSONIC AIR–AIR EJECTORS WITH SECOND THROAT DIFFUSER

Helmut Uebelhack Aug. 1965 38 p refs
(VKI-TN-28) CFSTI: HC $2.00/MF $0.50

This report contains the results of an investigation of a supersonic air-air ejector with a second throat diffuser. In the theoretical part an estimation of the influence of a second throat is given. The experimental part contains the measured performance of an ejector with a constant area diffuser and a second throat diffuser. Parameters as induced mass flow rate, exit Mach number of the primary nozzle, the distance between the nozzle and the second throat and the angle of the conical ramp of the second throat were taken into account. Author

N66-21161# Aeronautical Research Labs., Melbourne (Australia).

A WIND TUNNEL INVESTIGATION OF THE AIRFLOW AROUND A TALL CITY BUILDING

T. H. Trimble Jan. 1965 34 p refs
(ARL/A-238) CFSTI: HC $2.00/MF $0.50

An investigation was made in a low speed wind tunnel of a model of the proposed terminal building to be erected in Melbourne for Trans-Australia Airlines. Near the doors of the passenger lounge and main hall which open to an internal carriage-way the relative wind speed and its direction were measured for free winds blowing through 360 degrees of azimuth. With certain provisions this speed, relative to the wind speed measured above and aerodynamically clear of the model building, could be restrained to approximately 0.65 under the worst condition. A visual examination was made of the turbulence existing in the forecourt in the presence of a variety of canopies, louvres, screens and walls. A combination of these has been recommended as providing the quietest conditions generally. Author

N66-21220# College of Aeronautics, Cranfield (England).

A METHOD OF PREDICTING THE AERODYNAMIC BLOCKAGE OF BLUFF BODIES IN A DUCTED AIRSTREAM

A. H. Lefebvre Nov. 1965 21 p refs
(COA-AERO-188) CFSTI: HC $1.00/MF $0.50

Consideration is given to the flow conditions in the vicinity of a bluff body immersed in a ducted airstream. By equating the pressure loss expressed in terms of drag coefficient and physical blockage to the pressure loss occurring in the flow expansion downstream of the plane of maximum aerodynamic blockage, a relationship between geometric and aerodynamic blockage is obtained. Author

N66-21278# Library of Congress, Washington, D. C. Aerospace Technology Div.

AN INVESTIGATION OF PRESSURE DISTRIBUTION ON CERTAIN STARLIKE BODIES AT NEARLY 4M [ISSLEDOVANIYE RASPREDELENIYA DAVLENIYA NA NEKOTORYKH ZVEZDOOBRAZNYKH TELAKH PRI CHISLE M 4]

Surveys of Soviet Scientific and Technical Literature

A. L. Gonor and A. I. Shvets 17 Mar. 1966 14 p refs Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), no. 6, 1965 p 122–125
(ATD-66-27)

An investigation was conducted in order to test the theory that starlike bodies have less drag and a greater lift-drag

ratio than conventional aerodynamic shapes at supersonic and hypersonic speeds. The experiments were carried out on drainage models with V-shaped wings at speeds approaching Mach 4. The measurements techniques are discussed, and test results are compared with theoretical calculations. It is pointed out that theoretical and experimental results are in good agreement, and that the evidence shows that the wave-drag coefficient for a starlike body is reduced several fold. D.T.

N66-21292# Naval Weapons Lab., Dahlgren, Va.
THE NEAR MAXIMUM TIME STEP FOR RIGID BODY/INTEGRATION USING THE FRICK SLIP FRAME
P. Daniels and C. W. Ingram 23 Dec. 1965 62 p refs
(NWL-2002; AD-627150) CFSTI: HC $3.00/MF $0.75

A method is derived for determining the near optimum spin scale factor and the near maximum time step for integration of the trajectories of spinning symmetrical missiles using the Frick slip frame. The trajectories of a typical spin-stabilized projectile and a fast spinning statically stable missile were computed in order to evaluate the method. The results of this study indicate that the technique is valid for missiles with moderate yaw. Author (TAB)

N66-21359# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Flight Dynamics Lab.
LOCAL AERODYNAMIC PARAMETERS FOR SUPERSONIC AND HYPERSONIC FLUTTER ANALYSES Technical Report, 1 Jul. 1964–1 Apr. 1965
James J. Olsen Oct. 1965 50 p refs
(AFFDL-TR-65-183; AD-626928) CFSTI: HC $2.00/MF $0.50

The report presents the results of an analysis to determine how certain aerodynamic flutter parameters are changed from their free stream values by the existence of supersonic and hypersonic nose shock waves and expansions. The results indicate that nose shock waves and expansions can create a new set of 'free stream' conditions for flutter analyses. These new free stream conditions can be sufficiently different from the undisturbed 'free stream' condition to warrant their detailed analyses in the supersonic and hypersonic vehicle. Author (TAB)

N66-21466# Massachusetts Inst. of Tech., Cambridge.
METHODS OF CONTROLLING THE ROLL DEGREE OF FREEDOM IN A WIND TUNNEL MAGNETIC BALANCE. PART I: PRODUCTION OF ROLLING MOMENTS Interim Technical Documentary Report, Jan. 1964–Mar. 1965
Timothy Stephens Wright-Patterson AFB, Ohio, ARL, Dec. 1965 49 p refs
(Contract AF 33(615)-1470)
(ARL-65-242; AD-628570) CFSTI: HC $4.00/MF $0.50

This report presents a discussion of methods of producing rolling moments by magnetic fields on a model suspended in a magnetic wind tunnel balance system. Two methods are described and compared: one involving the interaction of steady nonuniform fields with a nonuniformly magnetized body, and the other involving the interaction of an alternating uniform magnetic field with a closed loop of conducting material. The two alternative methods are translated into magnet configurations designed to satisfy the objective of a completely integrated six degree of freedom balance system. Author (TAB)

N66-21514# Toronto Univ., (Ontario). Inst. for Aerospace Studies.
A TURBULENCE PROBE UTILIZING AERODYNAMIC LIFT
T. E. Siddon Jun. 1965 40 p refs
(Grants AF-AFOSR-223-64; AF-AFOSR-672-64)
(UTIAS-TN-88; AD-627572) CFSTI: HC $2.00/MF $0.50

The concept of a new-type of anemometer for measuring the cross-stream or 'v'-component of turbulent velocity is presented. Basic theory concerning the response characteristics of the so-called 'aerofoil probe' is discussed. Steps in the development of a satisfactory prototype of the 'aerofoil probe' are outlined. Various problems concerning resonant frequencies, accelerometric effects, low-frequency response fall-off, and the effect of finite aerofoil size were encountered, and these are described in detail. A method of dynamic calibration employing a square-wave turbulence simulator is outlined. Various experimental data accumulated from measurements in a low-speed turbulent air jet are presented. These include velocity measurements, frequency spectra, autocorrelations, and two point space-time correlations. Comparisons with hot-wire data are made wherever possible. Conclusions are drawn as to feasibility of using the aerofoil probe in preference to hot-wire techniques for turbulence measurements. Limitations of both techniques are compared.
Transl. by R.N.A.

N66-21561*# Franklin Inst., Philadelphia, Pa. Research Labs.
COMPUTER CONTROL STUDY FOR A MANNED CENTRIFUGE Final Technical Report
John Stone, Ka-cheung Tsui, and Eugene Pack Jun. 1965 254 p
(Contract NAS9-3570)
(NASA-CR-65298; F-B2300-1) CFSTI: HC $6.00/MF $1.50
CSCL 14B

An analog simulation study of a man-rated centrifuge was undertaken to determine the capabilities of the centrifuge in producing various g levels versus time effects on a subject riding in the centrifuge gondola. A control computer converts g versus time input into command signals for the main arm, gimbal ring, and gondola drives; and a digital flow diagram is used in the actual control computer. Each of the main control systems was checked separately for nonlinear component effects on frequency response and for phase shifts. Limit circuits and their effects are investigated, and the gyroscopic forces on each of the systems are considered. Equations, which require special analog circuit configurations, are developed and methods for their solution are given. The concept of magnitude controlling of output g vector is considered, and a design study is presented. Feed forward compensation torques and control computer block diagrams are included. M.W.R.

N66-21562*# North American Aviation, Inc., Downey, Calif. Flight Sciences Dept.
STUDY OF FLOW FIELDS ABOUT AXISYMMETRIC BLUNT BODIES AT LARGE ANGLE-OF-ATTACK Final Report
29 Oct. 1965 183 p refs
(Contract NAS9-3159)
(NASA-CR-65329; SID-65-1353) CFSTI: HC $5.00/MF $1.25 CSCL 01A

The inverse method was used to develop an IBM 7094 computer program for calculating equilibrium, real gas inviscid flow fields about axisymmetric blunt bodies at large angles of attack traveling at supersonic speeds. The program will compute the subsonic and transonic flow regions behind the detached bow shock with sufficient supersonic data being

generated to allow initiation of a method-of-characteristics solution for the remainder of the flow field. The program will handle the Apollo Command Module (ACM) and a generalized class of body shapes, and results are presented for two cases: (1) the ACM in a real gas flow at 22° angle of attack and (2) a sphere at 40°. Appendices consider (1) transformation of conservation equations in vector notation into a cylindrical coordinate system and (2) the influence coefficient method.
M.W.R.

N66-21585*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATIC LONGITUDINAL AND LATERAL AERODYNAMIC CHARACTERISTICS AT A MACH NUMBER OF 2.01 OF A TAILLESS DELTA V/STOL CONFIGURATION HAVING VARIABLE-SWEEP WING PANELS
M. Leroy Spearman and Gerald V. Foster Washington, NASA, Dec. 1961 36 p refs
(NASA-TM-X-634) CFSTI: HC $2.00/MF $0.50 CSCL 01A (Declassified)

An investigation has been conducted in a supersonic pressure tunnel at a Mach number of 2.01 to determine the longitudinal and lateral aerodynamic characteristics of a tailless delta V/STOL configuration having variable-sweep wing panels and twin inlets. The results of the investigation indicated that the inlet and duct arrangement had a large detrimental effect on both the longitudinal and the directional stability characteristics of the configuration. The longitudinal stability was improved by reducing the sweep and increasing the span of the delta planform wing whereas the directional stability was improved through the use of an enlarged vertical tail.
Author

N66-21658*# Alabama Univ. Research Inst., Huntsville.
HYPERSONIC NON-EQUILIBRIUM FLOW AND ITS THERMODYNAMIC RELATIONS
Rudolf Hermann Nov. 1965 90 p refs Presented at 4th Space Symp., Geottingen, W. Germany, 18–22 Oct. 1965 (Grant NsG-381)
(NASA-CR-71398; UARI-30) CFSTI: HC $3.00/MF $0.75 CSCL 01A

Theoretical research dealing with hypersonic nonequilibrium and its underlying thermodynamic relations, including real gas effects, are reviewed. Equilibrium, nonequilibrium, and frozen flow are described; and attention is given to hypersonic flow fields, flow conditions, and flight regions during reentry. Nonequilibrium flow is considered (1) with oxygen dissociation through a hypersonic nozzle, (2) around blunt bodies with and without dissociation in the free stream, and (3) around a pointed cone with and without dissociation in the free stream. A simplified air model is used to present real gas effects; and a simplified gas model is used for calculation of inviscid flow through hypersonic nozzles, about the forward portion of blunt bodies, and of free cones.
M.W.R.

N66-21666# International Business Machines Corp., San Jose, Calif. Research Lab.
PAPERS ON THE CONTROL OF DISTRIBUTED PARAMETER AEROELASTIC SYSTEMS
M. L. Bandy, W. E. Langlois, and P. K. C. Wang Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Nov. 1965 174 p refs (Contract AF 33(657)-11545)
(RJ-305; NJ-62; AFFDL-TR-65-145; AD-627048) CFSTI: HC $5.00/MF $1.00

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3. ASYMPTOTIC STABILITY OF EQUILIBRIUM OF A SIMPLIFIED AERODYNAMIC VEHICLE WITH FLEXIBLE TAIL P. K. C. Wang p 65–71 refs (See N66-21669 11-32)
4. STABILITY ANALYSIS OF A SIMPLIFIED PITCH-CONTROLLED FLEXIBLE AERODYNAMIC VEHICLE VIA LYAPUNOV'S DIRECT METHOD P. K. C. Wang p 72–83 refs (See N66-21670 11-32)
5. OPTIMUM CONTROL OF A CLASS OF MIXED DISTRIBUTED AND LUMPED PARAMETER SYSTEMS P. K. C. Wang p 84–104 refs (See N66-21671 11-10)
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N66-21684# Library of Congress, Washington, D. C. Aerospace Technology Div.
INVESTIGATIONS OF SOVIET HYPERVELOCITY TESTING TECHNIQUES, COMPREHENSIVE REPORT Surveys of Communist World Scientific and Technical Literature
Alexis Baratoff 16 Dec. 1965 92 p refs *Its* Work Assignment No. 54
(ATD-65-114)

This comprehensive report is based on Soviet-Satellite open sources published 1924–1965. It concerns experimental research in high velocity aerodynamics and gas dynamics. Due to the complexity of the subject the report was divided into two sections. The first section lists facilities and personnel engaged in this field of research; it gives data on wind tunnels, shock tubes, and shock tube flows; a third chapter pertains to measurement techniques (velocity, density, temperature, and pressure). The second section deals with such problems of aerophysics as the state of a gas heated by a shock wave and related phenomena taking place behind a shock wave, such as dissociation, ionization, light emission, radiation, and formation of plasma. It includes chapters on shock tube flows, boundary layer interaction, physical properties of gases at high temperatures, heat transfer, mass transfer, and detonation. The research is based on simulation of the conditions encountered in space flights and reentry by creating high-speed, high-temperature ionized gas flows by means of shock waves produced in supersonic wind tunnels, shock tubes, discharge tubes, and by explosions. Emphasis has been placed on supersonic shock tube investigations. The shock wave methods employed in laboratory studies of the physical and physicochemical properties of various gases heated by shock waves at high temperatures, the specific apparatus, and the auxiliary means characteristic of many laboratories are described. Many new ideas and suggestions are expressed and

substantial improvements are noted. The report includes an introduction, analyst's comments, and 152 references.
Author

N66-21702*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC DATA ON A LARGE SEMISPAN TILTING WING WITH 0.5-DIAMETER CHORD, DOUBLE-SLOTTED FLAP, AND BOTH LEFT-HAND AND RIGHT-HAND ROTATION OF A SINGLE PROPELLER
Marvin P. Fink, Robert G. Mitchell, and Lucy C. White Washinton, NASA, Apr. 1966 121 p
(NASA-TN-F-3375) CFSTI: HC $1.50/MF $1.00 CSCL 01A

An investigation has been made in the Langley full-scale tunnel to determine the longitudinal aerodynamic characteristics of a large-scale semispan V/STOL tilt-wing configuration having a single propeller which was tested for both right- and left-hand rotation. The wing had a chord-to-propeller-diameter ratio of 0.5, a double-slotted flap, an aspect ratio of 4.88 (2.44 for the semispan), a taper ratio of 1.0, and an NACA 4415 airfoil section. The data have not been analyzed in detail but have been examined to observe the predominant trends. It was found that the direction of propeller rotation had no significant effect on the lift or descent capability attainable, although different types of flow-control devices were required to achieve the same results with different directions of rotation. The descent capability was determined from the values of attainable drag-to-lift ratios without stalling of any part of the wing within the propeller slipstream. The use of flaps was very effective in increasing the descent capability for either mode of rotation. For example, with the most favorable combination of flow-control devices tested, virtually no descent capability prior to wing stalling was achieved with 0° flap deflection, whereas, with 40°, 60°, or 70° flap deflection, a descent capability of about 20° was achieved.
Author

N66-21705*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INVESTIGATION OF SPLITTER PLATES FOR THE AERODYNAMIC SEPARATION OF TWIN INLETS AT MACH 2.5
George W. Moseley, John B. Peterson, Jr., and Albert L. Braslow Washington, NASA, Apr. 1966 52 p refs
(NASA-TN-D-3385) CFSTI: HC $0.75/MF $0.50 CSCL 01A

An experimental investigation was conducted to determine the ability of various splitter plates to isolate twin inlets aerodynamically, so that, in the event one inlet is unstarted, the operation of the other inlet will not be affected. The effects of pylon height, inlet mass flow, and inlet yaw on the performance of the splitter plates were investigated. A pylon-mounted external-internal compression inlet model was used. The tests were made at a Mach number of 2.5 and a Reynolds number based on cowl diameter of 10.8×10^6, which are approximately full-scale flight conditions for an aircraft such as a supersonic transport. It was determined that splitter plates of a practical size will isolate an unstarted inlet, at least as long as the mass-flow ratio is maintained above approximately 0.65. The effective splitter plates extended forward to the tip of the inlet centerbody, and the upper and lower edges of the plates extended above and below the cowl lip. An extension of 7.5 percent of the cowl diameter on the upper and lower edges was successful in preventing the unstarted flow field from spilling around the upper and lower edges. It was also found that splitter plates of practical size remained effective for yaw of the unstarted inlet to at least 6° windward and that pylon height had little effect on splitter-plate effectiveness except that at low heights where it was necessary that there be no gap between the splitter plate and the wing.
Author

N66-21729*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NEWTONIAN AERODYNAMICS FOR GENERAL BODY SHAPES WITH SEVERAL APPLICATIONS
W. H. Heybey 7 Feb. 1966 59 p refs
(NASA-TM-X-53391) CFSTI: HC $3.00/MF $0.50 CSCL 01A

The Aero-Astrodynamics Research Review contains a succinct account of Newtonian aerodynamics for general analytical surfaces. Much of the detail passed over there when dealing with applications, together with a more thorough exposition of the general approach, is given in the present report which, it is hoped, will be useful to those who wish to actually work with Newtonian's method. It ought to serve well in the high-Mach number, low-density phase of re-entry flight. The lemniscatic body chosen in the Research Review paper as an example for calculating blunt-nose forces is replaced here by a circular cone with spherical base cap, since this configuration seems to command more immediate interest.
Author

N66-21762# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
THE LIGHT-LINE-TETHERING TECHNIQUE FOR DETERMINING THE AERODYNAMIC DERIVATIVES OF AN AIR CUSHION VEHICLE
G. Kurylowich Sep. 1965 121 p refs
(Contract AF 33(657)-8451)
(UTIAS-110; AD-627573) CFSTI: HC $4.00/MF $0.75

A complete feasibility study was performed on a new technique for determining ACV aerodynamic derivatives. A circular track simulated 'ground' while the vehicle, tethered to a centerpost by means of a light cable, flew a circular flight path above the track surface. A step on the 'ground' perturbed the vehicle from equilibrium and the resulting oscillations were recorded by a movie camera. The results obtained indicated that many derivatives were functions of height. Although scatter in the data permitted a qualitative study only, it was concluded that the scatter resulted from random errors in the recorded time histories and the manner in which the cable was attached to the vehicle. By making certain improvements in the experimental design and apparatus (especially using a larger track) it was concluded that all derivatives could be obtained with satisfactory precision with this technique.
Author (TAB)

N66-21868# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF TWO-DIMENSIONAL JET-FLAP AERODYNAMIC INTERACTION AT SUPERSONIC SPEEDS
Norman E. Hawk and James L. Amick Oct. 1965 32 p refs
Its Rept.-06089-1-T
(APL/JHU-CR-23)

Two-dimensional jet flap aerodynamic interaction tests were conducted in the 8 in. × 13 in. supersonic tunnel at Mach number 3.97 and Reynolds number 0.12×10^6 per inch. The test model consisted of a wedge of rectangular planform equipped with side plates and a full span jet slot. The primary

data taken were jet mass flow, normal force increment due to the jet, and schlieren photographs. The specific impulse ratios obtained varied from 3.6 at the lowest jet force parameter to 2.5 at the highest jet force parameter. (Jet force parameter is defined as the jet stagnation pressure times jet slot width, divided by free-stream pressure times body length). For the range of variables covered in the present experiment the jet force parameter was found to govern the flow geometry, including transition in the separated shear layer. Data on aerodynamic interaction in the case of the approximately two-dimensional, sonic jet flap have been collected from four sources. The available data for specific impulse ratio were correlated, mostly within ±10%, over a hundredfold range of a dimensionless parameter consisting of the jet force parameter multiplied by a free stream Mach number function. An inviscid theory was developed to provide an analytical justification for the dependence on the parameter. Author

N66-21896# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
A METHOD FOR PREDICTING THE AERODYNAMIC LOADS AND DYNAMIC RESPONSE OF ROTOR BLADES
Raymond A. Piziali Jan. 1966 110 p refs
(Contract DA-44-177-AMC-163(T))
(CAL-BB-1932-S-1; USAAVLABS-TR-65-74; AD-628583) CFSTI: HC $4.00/MF $0.75

A method for predicting the aerodynamic loads and the flapwise bending moments experienced by the blades of a rotor in steady translational flight has been developed. The blade representation which is used satisfies the chordwise aerodynamic boundary condition, and a simplified discrete vortex filament representation is used for the wake of each blade. An iterative procedure was developed which yields a simultaneous solution for the aerodynamic loads and dynamic response experienced by the rotor blades. The lift loadings and bending moments were computed for two flight conditions of the H-34 and HU-1A rotors. Comparisons of these results with measured results are presented as time histories and radial distributions of the harmonic components. Author (TAB)

N66-21907# David Taylor Model Basin, Washington, D. C. Aerodynamics Lab.
LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF SEVERAL HYPERSONIC AIRCRAFT CONFIGURATIONS AT A MACH NUMBER OF 9.45
John R. Krouse and Bertram K. Ellis Jan. 1966 47 p refs
(AERO-1099; DTMB-2153; AD-628160) CFSTI: HC $4.60/MF $0.50

Wind-tunnel tests were conducted at a Mach number of 9.45 to determine the longitudinal aerodynamic characteristics of several conceptual hypersonic aircraft configurations, consisting of various half-cone-cylinder bodies and double-delta wings. Effects of body volume, vehicle orientation, wing planform, and wing-tip dihedral were determined. In general, the lift-to-drag ratios of all high-wing configurations varied slightly over an angle-of-attack range of 0 degrees to 12 degrees, reaching a maximum value of 2.7 around 6 degrees. On the other hand, the lift-to-drag ratios of all low-wing configurations increased continuously with increasing angle of attack, eventually reaching maximum values of roughly 3.0 near 12 degrees. In all cases, fuselage base drag accounted for less than 4 percent of the total drag. For the arbitrarily chosen center-of-gravity location, all low-wing configurations were unstable, unbalanced, or both; whereas several high-wing configurations were both stable and balanced.
Author (TAB)

N66-21921# ARO, Inc., Arnold Air Force Station, Tenn.
A COMPARISON OF EXPERIMENTAL AND THEORETICALLY PREDICTED PRESSURE DISTRIBUTIONS AND FORCE AND STABILITY COEFFICIENTS FOR A SPHERICALLY BLUNTED CONE AT M_∞~18 AND ANGLES OF ATTACK
Eugene C. Knox and Clark H. Lewis Arnold Eng. Develop. Center, Feb. 1966 65 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-65-234; AD-627317) CFSTI: HC $3.00/MF $0.75

Analysis of experimental pressure distributions and force and moment coefficients for a 9-deg half-angle spherically blunted cone is presented based on an ideal gas (γ=1.4) three-dimensional characteristics solution. Comparisons are also made with predictions based on modified Newtonian theory. TAB

N66-22179*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROPELLER-ROTOR WHIRL FLUTTER: A STATE-OF-THE-ART REVIEW
Wilmar H. Reed, III [1965] 44 p refs Presented at the Symp. on the Noise and Loading Actions on Helicopter V/STOL Aircraft and Ground Effect Machines, Southampton, England, 30 Aug.–13 Sep. 1965
(NASA-TM-X-56678) CFSTI: HC $2.00/MF $0.50 CSCL 01A

The basic phenomenon of propeller whirl instability in connection with conventional and V/STOL aircraft is described; theoretical and experimental investigations of the problem from the time it first became of concern on contemporary turboprop aircraft to the present are summarized. Author

N66-22232# Royal Aircraft Establishment, Farnborough (England).
THE FLAPPING BEHAVIOUR OF A HELICOPTER ROTOR AT HIGH TIP-SPEED RATIOS
E. Wilde, A. R. S. Bramwell, and R. Summerscales Apr. 1965 36 p refs
(RAE-TR-65068) CFSTI: HC $2.00/MF $0.50

The blade flapping equation has been solved on an analogue computer taking into account the reversed flow region but neglecting stall. The fully articulated blade becomes unstable at about μ=2.3, whilst a see-saw rotor is stable up to μ=5 at least and the trends suggest that it may be stable for all μ. However, the response to a gust, or the equivalent change of no-feathering axis angle, is almost the same for both rotors up to about μ=0.75. For a 35 ft/sec gust at a forward speed of 200 ft/sec, and typical rotor/fuselage clearance, this represents the limiting tip-speed ratio for either rotor. The better response of the see-saw rotor, however, makes it possible to increase the limiting tip-speed ratio by some form of flapping restraint. This has been investigated by considering the effects of springs and dampers, and offset and δ_3-hinges. Author

N66-22273*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HYPERSONIC AERODYNAMIC CHARACTERISTICS OF AIRCRAFT CONFIGURATIONS WITH CANARD CONTROLS
Cuyler W. Brooks, Jr. and Clarence D. Cone, Jr. Washington, NASA, Apr. 1966 60 p refs
(NASA-TN-D-3374) CFSTI: HC $0.85/MF $0.50 CSCL 01A

The aerodynamic characteristics of a canard-control, wing-body configuration having a 70°-swept-delta wing were studied at a Mach number of 10.03 in hypersonic flow apparatus. The effects of canard size and planform, body length, wing position, and vertical-tail position on the longitudinal, lateral, and directional characteristics were determined. The stability and lift characteristics of these configurations are nonlinear because of the nature of the hypersonic flow regime; these experimental nonlinearities are qualitatively predicted by Newtonian impact theory. Effects of canard deflection and wing vertical position on the variation of lift coefficient with angle of attack indicate that there is a measurable interference effect of the canard shock field and/or wake on the flow under the high wing. Canard control effectiveness is somewhat greater for the trapezoidal than for the delta canard and increases with body length (canard moment arm) for the high-wing configurations. For the low-wing configurations an increase is found only for the highest canard deflection. The canards have negligible effects on the lateral and directional stability of the configurations except at the higher angles of attack. The vertical tails are directionally stabilizing, as would be expected, but the dihedral effect of the vertical tails is dependent on the wing vertical position. The high-wing configurations are considerably more stable laterally and directionally than the corresponding low-wing configurations. Author

N66-22274*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECTS OF BLUNTNESS ON THE SUBSONIC DRAG OF AN ELLIPTICAL FOREBODY

John D. Norris and Robert J. Mc Ghee Washington, NASA, Apr. 1966 22 p refs

(NASA-TN-D-3388) CFSTI: HC $0.30/MF $0.50 CSCL 01A

An investigation has been conducted in an 8-foot transonic pressure tunnel to determine the effects of forebody bluntness on the subsonic drag coefficient of a family of elliptical forebodies in combination with a cylindrical afterbody. Most of the tests were conducted at a constant Reynolds number of 6.3×10^6 (based on length of cylindrical afterbody) through a Mach number range from 0.20 to 0.90. In addition, at a Mach number of 0.60, tests were conducted over a Reynolds number range from approximately 4.1×10^6 to 13.3×10^6. All tests were conducted at 0° angle of attack. The results indicate that increasing the forebody bluntness rapidly decreased the drag-rise Mach number, except where flow separation ahead of the forebody shoulder occurred. The presence of shock systems at the high subsonic Mach numbers steepens the pressure gradient and promotes separation for moderate forebody bluntness. It appears that for a Mach number equal to or less than 0.60 a bluntness ratio as low as 0.65 can be tolerated before a large increase in drag occurs. Author

N66-22278*# Wichita Univ., Kans.

A REVIEW OF THE PLANFORM EFFECTS ON THE LOW-SPEED AERODYNAMIC CHARACTERISTICS OF TRIANGULAR AND MODIFIED TRIANGULAR WINGS

Kenneth Razak and Melvin H. Snyder, Jr. Washington, NASA, Apr. 1966 101 p refs

(Grant NGR-17-003-002)

(NASA-CR-421) CFSTI: HC $1.25/MF $0.75 CSCL 01A

The fundamental aerodynamic phenomena of the flow around sharp leading edge triangular planform wings is reviewed. Analytical methods of predicing lift characteristics of triangular wings are summarized and experimental results of tests on wings of various planform are presented. A bibliography of 258 references is included. Author

N66-22281*# National Aeronautics and Space Administration, Washington, D. C.

WORKING CONDITIONS OF THE INTERNAL BOUNDARY LAYER BLEED OF AN EXTERNAL SUPERSONIC COMPRESSION AIR INTAKE [FONCTIONNEMENT DU PIEGE A COUCHE LIMITE INTERNE D'UNE PRISE D'AIR A COMPRESSION SUPERSONIQUE EXTERNE]

J. Leynaert Jan. 1966 27 p refs Transl. into ENGLISH from French Presented at the AGARD Specialists Meeting on the Aerodyn. of Power Plant Installation, Tullahoma, Tenn., 25-28 Oct. 1965 *Its* Reprint No. 288

(NASA-TT-F-9869) CFSTI: HC $2.00/MF $0.50 CSCL 01A

The theory of operation of an external supersonic airscoop, using a bleed with internal boundary layer, is discussed from the viewpoint of flow separation and re-attachment at oblique and curved inlet shocks. An attempt is made to apply experimental data for optimizing the efficiency of air intakes at three-dimensional flow. Schematized layouts are given for strategic location of the boundary-layer bleed at the inlet of the subsonic diffuser, for preventing separation of flow during change-over from supersonic to subsonic regime, in flights of Mach-2 supersonic transports. Author

N66-22283*# National Aeronautics and Space Administration, Washington, D. C.

CALCULATION OF THE AERODYNAMIC INTERFERENCE OF A SYSTEM OF BODIES IN AN IDEAL FLUID [O RASCHETE AERODINAMICHESKOY INTERFERENTSII SISTIMY TEL V IDEAL'NOY ZHIDKOSTI]

D. N. Gorelov Jan. 1966 18 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan i Mashinostr. (Moscow), no. 5, 1964 p 33-38

(NASA-TT-F-9882) CFSTI: HC $1.00/MF $0.50 CSCL 01A

Description of a method for machine computation of the aerodynamic interference of a system of bodies, which is suitable for solving a wide class of linear problems for which the principle of superposition is applicable. The method is based on the representation of the velocity potential of flows past a system of bodies in the form of a sum of velocity potentials of flows past individual bodies, taking into account a certain desired downwash which varies along the surface of a body and which is dependent on the interference of other bodies in the system. As an example, the problem of unsteady flow of an incompressible fluid past a biplane is solved. Author

N66-22286# Advisory Group for Aerospace Research and Development, Paris (France).

AERODYNAMICS OF POWER PLANT INSTALLATION, PART 2

Oct. 1965 400 p refs Proc. of a Specialists Meeting, Sponsored by the AGARD Fluid Dyn. Panel, Tennessee, 25-27 Oct. 1965

(AGARDograph-103, Pt. 2) CFSTI: HC $7.00/MF $2.00

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J.-M. Hardy (Soc. Natl. d'Etude et de Construction de Moteurs d'Aviation) and J. Delery (France. Office Natl. d'Etudes et de Rech. Aérospatiales) p 445–478 refs (See N66-22289 11-01)

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N66-22287 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN INVESTIGATION OF SPLITTER PLATES FOR SUPERSONIC TWIN INLETS

John B. Peterson, Jr. *In* AGARD Aerodyn. of Power Plant Installation, Pt. 2 Oct. 1965 p 373–409 refs (See N66-22286 11-01) CFSTI: HC $7.00/MF $2.00

An experimental investigation was conducted to determine the ability of various splitter plates to isolate twin inlets aerodynamically such that in the event that one inlet is unstarted, the operation of the other inlet will not be affected. The effects of pylon height, inlet mass flow, and inlet yaw, on the performance of splitter plates were investigated. A pylon-mounted external-internal compression inlet model was used and the tests were made at a Mach number of 2.5 and a Reynolds number, based on cowl diameter, of 10.8×10^6 (approximately full-scale flight conditions for an aircraft such as a supersonic transport). It was determined that splitter plates of a practical size will isolate an unstarted inlet at least as long as the mass flow ratio is maintained above approximately 0.65. Author

N66-22288 Royal Aircraft Establishment, Bedford (England).

BOUNDARY-LAYER INTERACTION EFFECTS IN INTAKES WITH PARTICULAR REFERENCE TO THOSE DESIGNED FOR DUAL SUBSONIC AND SUPERSONIC PERFORMANCE

J. Seddon *In* AGARD Aerodyn. of Power Plant Installation, Pt. 2 Oct. 1965 p 411–444 refs (See N66-22286 11-01) CFSTI: HC $7.00/MF $2.00

The nature of flow in intakes with external boundary-layer, at subsonic and supersonic speeds, is described. On the basis of a systematic series of wind tunnel tests, a quantitative assessment is made of the loss of pressure recovery due to interaction between the boundary-layer and the pre-entry pressure gradient, including, when present, the normal shock. The analysis leads to a formula which is suggested for general application. Boundary-layer control to reduce or eliminate the interaction loss may require to take special form when it is necessary not only to safeguard the supersonic performance but also to minimize the subsonic drag. Some brief discussion of this problem is given. Author

N66-22289 Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France).

ACTUAL POSSIBILITIES OF A THEORETICAL STUDY OF A SUPERSONIC NOZZLE AT DOUBLE-FLUX [POSSIBILITIES ACTUELLES D'ETUDE THEORIQUE D'UNE TUYERE SUPERSONIQUE A DOUBLE-FLUX]

Jean-Marie Hardy and Jean Delery (France. Office Natl. d'Etudes et de Rec. Aerospatiales) *In* AGARD Aerodyn. of Power Plant Installation, Pt. 2 Oct. 1965 p 445–478 refs In FRENCH; ENGLISH summary (See N66-22286 11-01) CFSTI: HC $7.00/MF $2.00

Following a brief review of the methods used in the design of by-pass nozzles (for both low and high secondary mass flows), a comparison is made with experimental results which shows the excellent agreement obtained when the fluid utilized for the primary and secondary flows is air at ambient temperature. In the case of a real air exhaust (γ and temperature variable), a critical survey of the theory shows that the effect of these factors is effectively taken into account in the case of high mass flows. Author

N66-22290 Man-Turbomotoren G.m.b.H., Munich (West Germany).

METHODS OF MEASURING AERODYNAMIC EFFICIENCY AND THRUST VECTORS OF ENGINE EXHAUST SYSTEMS

N. Scholz *In* AGARD Aerodyn. of Power Plant Installation, Pt. 2 Oct. 1965 p 479–501 (See N66-22286 11-01) CFSTI: HC $7.00/MF $2.00

VTOL technology requires complex exhaust system configurations, of which the flow losses and thrust vectors are difficult to estimate. In most cases it is therefore necessary to determine the aerodynamic parameters of the system by testing models in cold air. The necessary analyses of the test results from which these parameters are obtained and three fundamental methods of test are discussed, namely, a thrust force measuring method, a stream tube method and a momentum method. This last method is discussed in some detail and its application is demonstrated by means of some test results. Author

N66-22291 Technical Univ. of Norway, Trondheim.

PROPULSION SYSTEM INTEGRATION IN WINGS

J. Lockwood Taylor *In* AGARD Aerodyn. of Power Plant Installation, Pt. 2 Oct. 1965 p 503–511 refs (See N66-22286 11-01) CFSTI: HC $7.00/MF $2.00

The vortex drag of a wing can be appreciably reduced by adding a tip body, and theory does not make any radical distinction between such a body and a tip duct representing a jet engine nacelle. Wind-tunnel tests on a wing with such

a duct fitted confirmed the increase in lift and lift/drag ratio. These were low-speed wind-tunnel tests, and a correction was applied for the excess drag due to flow through the duct, since this would be replaced by the jet thrust in practice. A further correction for external duct drag seems also justifiable since no extra drag is, in fact, incurred by transferring the nacelle to the wing-tip location. In principle the extension to high speeds seems permissible since there is still vortex drag associated with the spanwise lift distribution, which may, in fact, be such as to given an even greater scope for improvement, by fitting a tip nacelle. Author

N66-22298 Royal Aircraft Establishment, Farnborough (England).
AERODYNAMIC INTERFERENCE EFFECTS WITH JET LIFT SCHEMES ON V/STOL AIRCRAFT AT FORWARD SPEEDS
John Williams and Maurice N. Wood *In* AGARD Aerodyn. of Power Plant Installation, Pt. 2 Oct. 1965 p 619–651 refs (See N66-22286 11-01) CFSTI: HC $7.00/MF $2.00

The nature and magnitude of aerodynamic interference effects which can arise with jet and fan lift schemes for V/STOL aircraft are considered, particularly as regards possible adverse flows induced around the airframe by the jet (or fan) efflux during aircraft transition to and from purely wing-borne flight. The discussion is based mainly on aerodynamic research at RAE and concentrates on the understanding and analysis of major features, rather than on optimization of specific aircraft layouts. Attention is also drawn to some important aerodynamic problems which warrant further extensive study. Author

N66-22299 National Research Council of Canada, Ottawa (Ontario).
EXPERIMENTAL STUDIES OF VTOL FAN-IN-WING INLETS
U. W. Schaub *In* AGARD Aerodyn. of Power Plant Installation, Pt. 2 Oct. 1965 p 715–747 refs (See N66-22286 11-01) CFSTI: HC $7.00/MF $2.00

The inflow problems associated with inlets, whose axes are perpendicular to the plane of the wing, have been studied in detail statically and at forward speed. Emphasis is placed on the distribution of velocity, total pressure loss, swirl and inflow-to-axis angles in the inlet as a function of inflow ratio and wing angle of incidence. These inlet annulus distributions feature, in general, a quasi-two-dimensional appearance with the inflow velocities being highest in the leading annulus sector. Flow distortion is observed to be a function of inflow ratio, inlet geometry, leading lip boundary layer separation and wing incidence angle. In the family of inlets dealt with, the leading lip boundary layer separates only at forward speed. Separated inlet flows cause substantially greater flow distortion than fully attached flows at the same inflow ratio. Such flow distortion is found to cause an unsuitable environment for steady state fan operation. The problems involved in starting a fan while in flight are considered, and solutions to these problems are proposed. Author

N66-22306# Advisory Group for Aerospace Research and Development, Paris (France).
AERODYNAMICS OF POWER PLANT INSTALLATION, PART 1
Oct. 1965 388 p refs Proc. of a Specialists Meeting, sponsored by the AGARD Fluid Dyn. Panel, Tenn., 25–27 Oct. 1965
(AGARDograph-103, Pt. 1) CFSTI: HC $7.00/MF $2.00

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11. INTAKE DESIGN AND PERFORMANCE AROUND A MACH NUMBER OF 2.2 M. C. Neale (Natl. Gas Turbine Estab.) p 301–323 refs (See N66-22317 11-01)

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13. A GENERAL METHOD FOR CALCULATING LOW SPEED FLOW ABOUT INLETS J. L. Hess and A. M. Smith (Douglas Aircraft Co.) p 345–372 refs (See N66-22319 11-01)

N66-22308 Boeing Co., Seattle, Wash.
A DISCUSSION OF SELECTED AERODYNAMIC PROBLEMS OF INTEGRATION OF PROPULSION SYSTEMS WITH AIRFRAME ON TRANSPORT AIRCRAFT
Walter C. Swan *In* AGARD Aerodyn. of Power Plant Installation, Pt. 1 Oct. 1965 p 23–68 refs (See N66-22306 11-01) CFSTI: HC $7.00/MF $2.00

This paper inspects our current knowledge on integration of engine nacelles on transport aircraft with special emphasis being placed on the aerodynamic forces which produce lift and drag. The subsonic case is treated first, showing how current aircraft drag estimates are made, and where

theory is weak. Then the supersonic case is explored with the emphasis here being placed on pressure drag due to volume and lift. Some hope for major gains are suggested. Author

N66-22310 Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
THE BLUNT TRAILING EDGE AXIAL-FLOW SUPERSONIC COMPRESSOR
F. Breugelmans *In* AGARD Aerodyn. of Power Plant Installation, Pt. 1 Oct. 1965 p 117-152 refs (See N66-22306 11-01) CFSTI: HC $7.00/MF $2.00
(Grants AF-EOAR 63-88; AF-EOAR 64-4)

A 40 cm tip-diameter rotor, using blunt trailing edge blades was designed to produce a total pressure ratio of 3.5 at a tip Mach number of 1.70. Some general observations are made on the flow in pipes of constant area, ducts of the P-A power family and flows through sudden area enlargements. Both subsonic and supersonic Mach numbers are considered. The influence of Mach number, divergence of the channel, sudden area increase and back pressure on the flow behaviour is discussed. The supersonic cascade experiments are presented from the point of view of pipe flow. The rotor investigation was carried out up to 92% of the nominal speed and had to be stopped there, owing to mechanical problems. The blade section performance is analyzed from the point of view of pipe flow and compared to theoretical results. All the data obtained on stalling incidence and losses are compared. The tests were carried out in a mixture of Freon 12 and air and were converted into air equivalent performance. No inlet guide vanes and no stator have been used so far. Author

N66-22313 Entwicklungsring Sud, Munich (West Germany).
LOW-DRAG INSTALLATION OF TWIN PROPULSION NOZZLES IN THE REAR OF THE FUSELAGE FOR TRANSONIC AND SUPERSONIC FLIGHT
Helmut Langfelder *In* AGARD Aerodyn. of Power Plant Installation, Pt. 1 Oct. 1965 p 195-216 refs (See N66-22306 11-01) CFSTI: HC $7.00/MF $2.00

A very large number of parameters influences the low drag installation of twin engine nozzles in the rear of the fuselage. For the project of a medium tactical fighter, various models were tested. Pressure measurements were made on the afterbody, the base and the internal and external nozzle surfaces in order to understand the flow. A twin propulsion nozzle installation requires careful attention to the shape of the boattail, since the drag associated with this in the transonic range may be much larger than the base drag. Base drag was comparatively small in the case investigated. The influence of ejector nozzles with venting of base areas was also investigated. The purpose of the ejector nozzle is mainly the increase of thrust obtained at supersonic speeds because of its divergent nozzle section. The results of these investigations of boattail and base pressure drags, and of the secondary ejector drag, are presented and discussed, together with some comments on ejector nozzle behavior. Author

N66-22317 National Gas Turbine Establishment, Pyestock (England).
INTAKE DESIGN AND PERFORMANCE AROUND A MACH NUMBER OF 2.2
M. C. Neale *In* AGARD Aerodyn. of Power Plant Installation, Pt. 1 Oct. 1965 p 301-323 refs (See N66-22306 11-01) CFSTI: HC $7.00/MF $2.00

The paper considers the selection of a shock geometry for a two-dimensional intake for operation at M=2.2. Either combined external/internal compression or all external compression arrangements are possible, and preliminary theoretical arguments point the need for experimental information to assist the choice. Appropriate test programs are described. It is concluded that the external compression geometry is to be preferred. Some areas for further research are indicated. Author

N66-22318 France. Office National d'Etudes et de Recherches Aeronautiques, Chatillon-sous-Bagneux.
FUNCTIONING OF AN INTERNAL BOUNDARY LAYER TRAP OF AN AIR INTAKE WITH EXTERNAL SUPERSONIC COMPRESSION [FONCTIONNEMENT DU PIEGE A COUCHE LIMITE INTERNE D'UNE PRISE D'AIR A COMPRESSION SUPERSONIQUE EXTERNE]
Jacky Leynaert *In* AGARD Aerodyn. of Power Plant Installation, Pt. 1 Oct. 1965 p 325-343 refs In FRENCH; ENGLISH summary (See N66-22306 11-01) CFSTI: HC $7.00/MF $2.00

It was observed that the actual shock is oblique and curved, and that a limited transonic expansion occurs over the trap. The boundary of the flow under this expansion is formed by a constant pressure mixing layer; the bleed mass flow is concentrated in a jet originating near the reattachment point of this mixing layer on the diffuser leading-edge. The study of the flow equilibrium conditions at the reattachment point shows that the bleed mass flow rate is determined as a function of the engine mass flow rate. When the latter decreases, the bleed mass flow rate increases, so that the trap acts like an automatic bypass, and thus the subcritical regime is avoided. The evolution of the shock curvature and of the extent of the internal transonic expansion maintains a constant efficiency within the range of application of this phenomenon. This range depends upon the maximum mass flow rate allowed by the secondary air exhaust system. Under normal working conditions, a slight variation in the mass flow control has only a local effect, and does not affect the flow at the diffuser exit. Author

N66-22319 Douglas Aircraft Co., Inc., Long Beach, Calif.
A GENERAL METHOD FOR CALCULATING LOW SPEED FLOW ABOUT INLETS
John L. Hess and A. M. O. Smith *In* AGARD Aerodyn. of Power Plant Installation, Pt. 1 Oct. 1965 p 345-372 refs (See N66-22306 11-01) CFSTI: HC $7.00/MF $2.00
(Contract Nonr-2722(00))

A set of digital computer programs has been developed that can calculate with high accuracy the inviscid incompressible flow about arbitrary two-dimensional, axisymmetric, and three-dimensional bodies. This paper describes how these programs can be used as design tools in problems involving inlets or power plant installations in general and illustrates their effectiveness in these applications. The basic method is outlined, and the techniques used to apply it to inlets, shrouds, and ducts are described. The ability of the method to predict real flow is exhibited by comparing calculated and experimental pressure distributions on a variety of configurations. Finally, several applications of this method to design problems are presented, both with and without experimental correlations. It is evident that this method can usefully supplement wind tunnel tests, and in some cases can replace them. Author

N66-22332* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TRISONIC AERODYNAMIC LOADS STUDY

Bob G. Dunn *In its* Aero-Astrodyn. Res. Rev., No. 3 15 Oct. 1965 p 17-22 refs (See N66-22329 11-34) CFSTI: HC $4.00/MF $1.00

This study is intended to define the linear aerodynamic load distributions on basic missile and launch vehicle shapes. Since theoretical means are not available in the transonic regime to accurately predict loads, experimental data are being used in the Mach number range from 0.7 to 2.0. By correlating data from the literature with the results of a supplementary test program, aerodynamic load distributions for cones and cone cylinders have been obtained and published. A test program is in progress to define linear local loads on cone-cylinder-flare-cylinder shapes. The analysis of these data has recently begun, the final results of which are to be published in August 1966. Author

N66-22361*# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
APPLICATION OF THE INVERSE TECHNIQUE TO THE FLOW OVER A BLUNT BODY AT ANGLE OF ATTACK
William W. Joss Washington, NASA, Apr. 1966 31 p refs (Contract NASr-119)
(NASA-CR-445) CFSTI: HC $0.50/MF $0.50 CSCL 01A

A method for the numerical solution of the flow behind a nonaxisymmetric bow shock is described. This method has been programmed for an IBM 7044 digital computer for the case of an ideal gas, and the calculation time is approximately ten minutes. For a specified bow shock the program generates the subsonic flow, a portion of the supersonic flow, and the body shape which will support the specified shock. Sample results are shown for three different shock shapes. Author

N66-22375*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATIC LONGITUDINAL AND LATERAL AERODYNAMIC CHARACTERISTICS AT A MACH NUMBER OF 2.20 OF A V/STOL AIRPLANE CONFIGURATION WITH A VARIABLE-SWEEP WING AND WITH A SKEWED WING DESIGN
Odell A. Morris and Gerald V. Foster Washington, NASA, Apr. 1961 33 p refs
(NASA-TM-X-521) CFSTI: HC $2.00/MF $0.50 CSCL 01A (Declassified)

An investigation has been conducted in the supersonic pressure tunnel at a Mach number of 2.20 to determine the static longitudinal and lateral aerodynamic characteristics of a V/STOL airplane configuration with a variable-sweep wing having outboard panels swept back 75° and with a skewed wing having wing skew angles of 0°, 30°, 60°, and 90°. The results show a linear variation of the pitching-moment coefficient with lift coefficient for both the configuration with a 75° swept wing and the skewed-wing configuration for wing skew angles up to 30°. Increasing the wing skew angle from 30° to 90° produced nonlinear pitching-moment curves with a sizable positive trim change. Both model configurations had unstable directional characteristics above angles of attack of approximately 2°. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N66-21125# Hughes Tool Co., Culver City, Calif. Aircraft Div.
COMPONENT TESTING: XV-9A HOT CYCLE RESEARCH AIRCRAFT Summary Report, 29 Sep. 1962-15 Mar. 1966
G. D. Deveaux Nov. 1965 199 p refs
(Contract DA-44-177-AMC-877(T))
(USAAVLABS-TR-65-38; HTC-AD-64-26(385-T-16); AD-627361) CFSTI: HC $5.00/MF $1.25

The component tests included fatigue tests of the blade root-end and constant section areas, hub gimbal system, spar-to-segment and root-fitting-to-spar attachments, and material evaluation tests of the blade spars. Sealing tests were conducted on the joint between the Y-duct and triduct in the hub area, the joint area between the gas generator and diverter valve, and the fixed-duct joint on the rotor blade. Blade natural frequency tests were conducted to ensure that the natural frequencies of the rotor blade would not be in a critical frequency range. The instrumented flight blade was calibrated in a test fixture before the flight test program. Author (TAB)

N66-21203# Arizona State Univ., Tempe.
DEVELOPMENT AND APPLICATION OF A METHOD TO DETERMINE AIRCRAFT FEASIBILITY FOR ISOLATED AREA SUPPORT
John Le Roy Moore (M.S. Thesis) Jun. 1966 177 p refs
(Contract AF 33(608)-1204)
(AD-624685) CFSTI: HC $5.00/MF $1.00

The purpose of this study is: (1) To develop a method which will allow the comparison of various aircraft with respect to their economic and physical feasibility to conduct the isolated area operation, and (2) To apply the method and evaluate classes and individual types of cargo aircraft as major parameters affecting feasibility are varied. TAB

N66-21330# Aviation Safety Engineering and Research, Phoenix, Ariz.
HELMET DESIGN CRITERIA FOR IMPROVED CRASH SURVIVAL Final Technical Report
J. L. Haley, Jr., J. W. Tornbow, S. Macri, and G. J. Walhout Ft. Eustis, Va., Army Aviation Mater. Labs., Jan. 1966 135 p refs
(Contract DA-44-177-AMC-254(T))
(USAAVLABS-TR-65-44; AD-628678) CFSTI: HC $4.00/MF $1.00

The major crash survival variables affecting the design and testing of U.S. Army aircrewmen helmets are presented and discussed in this report. Such factors as head acceleration limits, impact velocity, impact surfaces, impact sites, suspension and retention harnesses, helmet ventilation, impact test methods and structural concepts are considered. An examination of all available data on the tolerance of the human head to deceleration was conducted. Consideration was given to an analysis of acceptable design limits. A parallel study of head injuries occurring in aircraft accidents was conducted to determine the significant injury areas of the head and correlate this to protection area and techniques. A cockpit survey was conducted to develop criteria for testing the helmet and liner materials. Consideration was given during the program to a preliminary investigation of helmet retention systems and head cooling techniques. A series of instrumented drop tests was conducted to investigate various helmet design concepts and materials. Double-shell and single-shell helmets of nearly equal weight were analyzed. The advantages and disadvantages of three different methods of helmet impact testing are discussed. Author (TAB)

N66-21892*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TRANSONIC AERODYNAMIC CHARACTERISTICS OF A TAILLESS FIXED-WING SUPERSONIC TRANSPORT MODEL
Edward J. Ray and Robert T. Taylor Washington, NASA, Apr. 1966 77 p refs
(NASA-TM-X-1214) CFSTI: HC $1.10/MF $0.75 CSCL 01A

An investigation has been made in the Langley high-speed 7- by 10-foot tunnel to determine the effects of wing planform and twist and camber on the aerodynamic characteristics of a tailless fixed-wing supersonic transport model throughout a Mach number range of 0.40 to 1.14. To determine these effects, three wing planforms with the same aspect ratios were investigated with and without twist and camber. The three wing planforms were a modified delta having an ogee-shaped leading edge, a delta, and a trapezoid. The results of the present study indicated that the wing planform differences had little effect on the aerodynamic center variations with Mach number and on the trimmed lift coefficients at reasonable landing attitudes. The wing twist and camber effects, however, were significant and the results indicated that the trapezoid configuration, which had the highest values of pitching-moment coefficient at zero lift, would exhibit the highest trimmed lift coefficients of the twisted and cambered wing configurations near reasonable landing attitudes. The static lateral data indicated that the twisted and cambered wing configurations had positive directional stability and positive effective dihedral for all Mach numbers of the investigation. The directional stability, however, of the twisted and cambered delta and trapezoid configurations was considerably greater than the directional stability of the twisted and cambered ogee configurations.
Author

N66-21900# Systems Technology, Inc., Hawthorne, Calif.
A STUDY OF CONVENTIONAL AIRPLANE HANDLING QUALITIES REQUIREMENTS. PART II: LATERAL-DIRECTIONAL OSCILLATORY HANDLING QUALITIES Final Report, Jan. 1963–May 1965
Irving L. Ashkenas Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Nov. 1965 74 p refs
(Contract AF 33(657)-10407)
(AFFDL-TR-65-65-138, Pt. II; AD-627989) CFSTI: HC $3.00/MF $1.25

This report is a codification in two parts of conventional aircraft handling qualities criteria. The results of this effort are to serve as an intermediate design guide in the areas of lateral-directional oscillatory and roll control. The roll handling qualities portion of this report uses as a point of departure the concept that control of bank angle is the primary piloting task in maintaining or changing heading. In the lateral oscillatory portion of this effort, in defining requirements for satisfactory Dutch roll characteristics, a fundmanetal consideration is the fact that the motions characterizing this mode are ordinarily not the pilot's chief objective. That is, he is not deliberately inducing Dutch roll motions in the sense that he induces rolling and longitudinal short-period motions. A worthwhile approach to establishment of Dutch roll damping requirements is to first establish the basic level, and then to study the varied influences of the disturbance parameters. This approach provides the basis for the material contained in this report. TAB

N66-21905# Hayes International Corp., Birmingham, Ala.
REINFORCED PLASTIC LANDING GEAR FOR UH-1 HELICOPTER Final Report
Leon R. Anderson and Robert D. Holmes Jan. 1966 127 p refs /ts Rept.-1188
(Contract DA-44-177-AMC-120(T))
(USAAVLABS-TR-66-3; AD-628681) CFSTI: HC $12.60/MF $1.00

The primary objective of this program was to determine the feasibility of using reinforced plastic material for helicopter landing gears. A comprehensive design study was made, a fiber glass reinforced plastic landing gear system for the UH-1 helicopter was fabricated, and a full scale item was subjected to static and drop tests. Materials used for fabrication were Owens Corning S-994 HTS 901 twelve end glass roving and Union Carbide ER-2270 epoxy resin with methylnadic anhydride. Fabrication was accomplished by Cincinnati Testing Laboratories (CTL) by a wet winding process. Final design was based on the following properties: Flexural Strength=183,000 psi; Interlaminar Shear Strength=7,000 psi; Compressive Strength=110,000 psi; Flexural Modulus=8×10^6 psi. The static and drop tests demonstrated a high degree of ruggedness and durability. One of the two reinforced plastic members of the landing gear systems was subjected to four ultimate design static tests and fifteen drop tests without damage or failure. The other member was subjected to all tests except one of the static tests.
Author (TAB)

N66-21906# Kellett Aircraft Corp., Willow Grove, Pa.
DOWNWASH TESTS OF THE DUAL TANDEM DUCTED PROPELLER VTOL RESEARCH AIRCRAFT CONFIGURATIONS TO EVALUATE ENGINE INLETS, PROTECTION DEVICES AND STUDY AERODYNAMIC INTERFERENCE
H. C. Curtiss, Jr. and R. W. Struble 1 Nov. 1965 158 p refs Film Supplement to This Report is Available from Bur. of Naval Weapons
(Contract NOw-64-0439-f)
(Rept.-179T80-12; AD-628669) CFSTI: HC $16.00/MF $1.00

A full scale half-model simulation of a dual tandem ducted propeller VTOL aircraft was tested under the severe environment caused by operation simulating vertical flight in close proximity to sand and crushed stone covered terrain. Four engine inlet protection devices were evaluated in this series of tests. A wing-like deflector device was tested in two configurations of different chord lengths. A full inlet screen and a blocked half-screen inlet protection device were also tested. It was found that due to its location in the upflow region, the full screen tended to collect particles and thereby aggravated inlet ingestion. The blocked half-screen and the deflector devices significantly reduced ingestion, but were not sufficiently effective to positively prevent engine damage. Tests over crushed stone caused significantly worse inlet ingestion and airframe damage problems than those experienced over sand.
Author (TAB)

N66-22170# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON FLIGHT TECHNOLOGY [LITERATUUROVERZICHT, LUCHTVAART-TECHNIEK]
12 Feb. 1966 23 p refs /ts Vol. 2, No. L-7
CFSTI: HC $1.00/MF $0.50

Abstracts and bibliographic notes are included on model description, flight properties and accomplishments, manufacturing materials, panel systems and instrumentation, airports, navigation and air traffic control, training and personnel, aerodynamics, strength and vibration research, loads, air pocket vehicles, and technical news. Transl. by J.O.

N66-22186# Aeronautical Research Council (Gt. Brit.)
ANALYSIS OF FLIGHT LOADS RECORDED ON COMET 4B AIRCRAFT BY MEANS OF THE FATIGUE LOAD METER
R. Hain Taylor London, HMSO, 1965 107 p refs (Supersedes RAE-TN-STRUCT-364; ARC-26698
(ARC-CP-820; RAE-TN-STRUCT-364; ARC-26698) HMSO: 17s 6d

Flight load data collected by means of fatigue load meters installed on Comet 4B aircraft are presented in full and analyzed to determine whether a seasonal variation exists. It is concluded that there is no evidence of such a variation, and this is probably due to the equipment of these aircraft with cloud collision warning radar. The use of this radar appears to result in a lower general level of turbulence being encountered. Some comparisons are also made with data from Comet 1 and Comet 2 aircraft. Author

N66-22222# Advisory Group for Aerospace Research and Development, Paris (France).
LOW-SPEED FLIGHT INVESTIGATION OF A JET TRANSPORT WITH A POWERED-LIFT BOUNDARY-LAYER CONTROL SYSTEM
R. O. Schade and H. L. Crane Jun. 1965 35 p refs Presented at the 26th Meeting of the AGARD Flight Mech. Panel, Paris, 9–11 Jun. 1965
(AGARD-503) CFSTI: HC $2.00/MF $0.50

The low-speed flight characteristics of a large jet transport equipped with a powered-lift boundary layer control system were investigated for developing high lift devices for reduction of approach and landing speeds. Performance capability, maneuver capability, longitudinal characteristics, and lateral directional characteristics were evaluated. In relation to possible criteria for performance margins for powered-lift airplanes, the speed margins appear to be primarily related to power-on stall speeds. At these speed margins, the maneuver margins were adequate and did not appear to be a problem or a limiting factor during powered-lift operation. For the speed range and test conditions covered, there were no large detrimental effects on handling qualities resulting from the use of powered-lift. It did not appear that the handling qualities requirements would be much different from those used for conventional jet transports. The powered-lift airplane showed sizable increases in noise levels which were primarily the result of the higher engine power setting in the approach. L.S.

N66-22231# Royal Aircraft Establishment, Farnborough (England).
THE ROLE OF MAGNETIC RECORDING IN AIRCRAFT INSTRUMENTATION
G. E. Bennett Dec. 1964 63 p refs
(RAE-TR-64077; AD-464388) CFSTI: HC $3.00/MF $0.75

The paper discusses the general and specific applications underlying the present-day widespread interest in magnetic recording for in-flight recording of data, with particular reference to the Concord and long-term operational recording. The basic magnetic recording process, data recording techniques and their limitations, and the recording medium are considered to the extent necessary to appreciate and assess the magnitude of the task presented by these requirements. Recorders and electronic units recently developed in Instrumentation and Ranges Department, R.A.E., and the current development of in-flight digital recording systems are described and their application to specific requirements discussed. Author

N66-22270*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
FLIGHT INVESTIGATION OF STABILITY AND CONTROL CHARACTERISTICS OF A 0.18-SCALE MODEL OF A FOUR-DUCT TANDEM V/STOL TRANSPORT
William A. Newsom, Jr. and Delma C. Freeman, Jr. Washington, NASA, Apr. 1966 49 p refs
(NASA-TN-D-3055) CFSTI: HC $0.70/MF $0.50 CSCL 01A

A flight investigation has been made to study the stability and control characteristics of a 0.18-scale model of a four-duct tandem V/STOL transport airplane. The tests included hovering flight in and out of ground effect and level flight and descent conditions in the transition speed range. The model had unstable pitching and rolling oscillations in hovering flight out of ground effect, but it could be controlled and maneuvered easily since the period of these oscillations was long. In hovering flight near the ground, the model experienced large erratic disturbances caused by the recirculation of the ducted-propeller slipstream. The longitudinal stability improved as speed was increased in the transition range and the pitching oscillations were about neutrally stable at the high-speed end of the transition range. Throughout most of the transition speed range, the model had an unstable Dutch roll oscillation and very low directional stability. The Dutch roll instability could be alleviated by the use of artificial damping in yaw. The model also experienced stalling of the upper outside duct surfaces which caused large erratic rolling moments or wing dropping in the landing-appraoch condition. In all flight regions, the minimum total control powers found to be satisfactory in the model flight tests were approximately equal to or less than the control powers planned for the full-scale airplane. Author

N66-22293 National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
JET VTOL POWER PLANT EXPERIENCE DURING FLIGHT TEST OF X-14A VTOL RESEARCH VEHICLE
L. Stewart Rolls *In* AGARD Aerodyn. of Power Plant Installation, Pt. 2 Oct. 1965 p 539–557 refs (See N66-22286 11-01) CFSTI: HC $7.00/MF $2.00

Ames Research Center has used a deflected-jet VTOL research vehicle (the X-14A) extensively to investigate the handling qualities requirements for VTOL aircraft. Some power plant problems encountered were thrust loss due to hot gas ingestion, compressor damage due to the ingestion of ground erosion debris, negative ground effect or "suck-down", and the demands on the engines for high thrust as well as bleed air supply for the reaction controls. Author

N66-22297 Ryan Aeronautical Co., San Diego, Calif.
LIFT-FAN V/STOL PROPULSION AND AIRFRAME INTEGRATION

Herbert E. Dickard *In* AGARD Aerodyn. of Power Plant Installation, Pt. 2 Oct. 1965 p 653–688 refs (See N66-22286 11-01) CFSTI: HC $7.00/MF $2.00

This paper reviews fundamental preliminary design considerations involved in the integration of turbojet powered lift-fan V/STOL aircraft propulsion systems, in terms of 1965 and past technology. The US Army's XV-5A lift-fan research vehicle is used as a basis of reference for later and improved lift-fan and jet engine technology. A lift-fan mechanical configuration is discussed briefly. Parameters relating lift-fan static lift to the power output of the turbojet engine in terms of gas horsepower and gas flow output are established. The effects of three higher energy turbojet cycles on these parameters are shown. Effects of the higher energy turbojet gas generator on the composite lift-fan propulsion system (engine, fans and gas transmission ducting) are also discussed. A brief demonstration of the influence of fan design pressure on propulsion weight and a structural weight trade-off is given and relative increases in useful load due to the more efficient propulsion system are also shown. The paper is concluded by presenting a spectrum of tactical lift-fan aircraft configurations with speed capability up to Mach 2.0. Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N66-21129# Joint Publications Research Service, Washington, D. C.
OPERATION OF STEAM GAS INSTALLATIONS
M. I. Korneyev et al 15 Mar. 1966 24 p refs Transl. into ENGLISH from Teploenerg. (Moscow), no. 1, Jan. 1966 p 2–5, 16–20
(JPRS-34573; TT-66-31013) CFSTI: $1.00

Attention was directed towards the conditions under which steam-gas power installations are started and towards the characteristics displayed during operation. Comparative analyses were made of the startup times of different power facilities and of the rates at which they are brought to full capacity loads. Attention was also directed towards reducing the percentage of harmful gases diffusing into the air as a result of the sulfur compounds in the liquid fuels used by the power plant installations. C.L.W.

N66-21154# Union Carbide Corp., Cleveland, Ohio. Consumer Products Div.
ALKALINE-MnO_2 BATTERY Final Report, 1 May 1962–31 Jan. 1965
J. Winger 28 Jun. 1965 105 p refs
(Contract DA-36-039-SC-89098)
(FR-8; AD-623329)

The development of a low temperature alkaline-MnO_2 primary cell is reported. This development includes investigations of electrochemical and mechanical cell features; cell model characterization and factory trials; and finalized cell construction. Included are detailed discussions in such areas as cathode formulation and structural investigations, anolyte investigations, examinations with high surface area zinc, separator trials, trials with cathode binders, and various experimentations. The cell has design parameters optimized in all areas of performance and possesses a high level of reliability. In addition, the following conditions of shelf and service maintenance are incorporated: 70% of 70°F capacity after (a) 12 months storage at 113°F, (b) 3 months storage at 130°F, and (c) 1 month storage at 160°F. C.T.C.

N66-21283# Library of Congress, Washington, D. C. Aerospace Technology Div.
ELECTROMAGNETIC AND ELECTROSTATIC GENERATORS, ANNOTATED BIBLIOGRAPHY Surveys of Soviet Scientific and Technical Literature
Jordan V. Randjelovic 15 Nov. 1965 35 p refs
(ATD-65-103)

In addition to developments in electromagnetic and electrostatic generators, annotated bibliographies are presented for developments in electric motors and machines, and associated technology. A more detailed breakdown of subject matter includes the following: synchronous generators, turbogenerators, inductor alternators, twin generator with split poles, ultrasonic frequency generators, single phase micromotors, asymmetrical rotors, magnetic circuits, and induction torque micromotors. D.T.

N66-21407*# Vickers, Inc., Torrance, Calif. Aerospace Div.
DEVELOPMENT OF A HYDROGEN-OXYGEN SPACE POWER SUPPLY SYSTEM Progress Report, Jul. 1–31, 1963
W. D. Morath [1963] 16 p
(Contract NAS3-2787)
(NASA-CR-71521; PR-91570-510-1) CFSTI: HC $1.00/MF $0.50 CSCL 10A

Work progress in the development of a hydrogen-oxygen space power supply system included reworking of a number of engine hardware parts; redesign of the oxygen injector and of an improved hydrogen valve; and a layout drawing for a new first stage cylinder head with a redesigned compressor drive mechanism. G.G.

N66-21418# Naval Research Lab., Washington, D. C.
DIRECT ENERGY CONVERSION Literature Abstracts
Dec. 1965 156 p refs
(AD-628049) CFSTI: HC $5.00/MF $1.00

This is the tenth in a series of bibliographies covering unclassified literature related to the direct conversion of energy. Subject coverage includes energy conversion, thermoelectricity, thermionics, photovoltic, magnetohydrodynamics, electrohydrodynamics, electrochemical, nuclear and energy storage. TAB

N66-21483# Pratt and Whitney Aircraft, East Hartford, Conn.
500-WATT FUEL-CELL POWER PLANT Interim Report, 1 Oct. 1964–31 Oct. 1965
T. Schiller Jan. 1966 44 p
(Contract DA-28-043-AMC-00320(E))
(Rept.-1; AD-628159) CFSTI: HC $4.60/MF $0.50

The purpose of the work required to be performed by the Contract is to demonstrate the feasibility of a man-portable, 500-watt, indirect, liquid hydrogen and air, fuel-cell power plant. Two independent units are to be developed—a hydrogen-generator assembly and a fuel-cell assembly. The hydrogen-generator assembly will convert the hydrocarbon

fuel to hydrogen by steam reforming, and the fuel-cell assembly will electrochemically oxidize the hydrogen with air into electrical energy. The two units will be integrated for operation and designed to produce 500 watts of net electrical power. The report presents the technical approach to be used to establish the feasibility of a compact 500-watt, liquid-hydrocarbon and air, fuel-cell power plant. The work to date has consisted of design studies to establish power-plant configuration. These studies indicate that the power plant will meet Contract requirements. TAB

N66-21509# Union Carbide Corp., Parma, Ohio. Research Lab.
THIN FUEL CELL ELECTRODES Second Quarterly Progress Report, 1 Aug.–31 Oct. 1965
M. B. Clark and K. V. Kordesch [1965] 41 p
(Contract DA-28-043-AMC-01344(E))
(Rept.-6; AD-627606) CFSTI: HC $2.00/MF $0.50

Thin electrodes of established structure and performance characteristics determined in an electrode and single cell testing program have been built into batteries of a rated output of 100 watts (6.6 volts, 15 amperes). Construction features of the batteries are outlined, and the testing facilities and procedures are described. The performance of the first two (of the contemplated 14) 100-watt batteries is described; initial polarization data are given, and the water balance achieved under varying operation conditions is discussed. Author (TAB)

N66-21521# Stanford Univ., Calif.
DEPT. OF MECHANICAL ENGINEERING. DIRECT ENERGY CONVERSION SYSTEMS Final Technical Report
Robert H. Eustis 29 Oct. 1965 25 p refs
(Contract AF 49(638)-1123; ARPA Order 246)
(AFOSR-65-2013; AD-627658) CFSTI: HC $1.00/MF $0.50

A brief summary is presented of the research conducted. Details of the work are reported in earlier reports. The scope of this program has included magnetogasdynamic, electrochemical, and thermoelectric studies. In addition to a summary of the research work, 22 technical papers and ten theses, generating from this work, are listed. Author (TAB)

N66-21663*# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Chemical Engineering.
CALORIMETRIC STUDY OF THE THERMODYNAMIC PROPERTIES OF THE NICKEL-CADMIUM CELL Final Report, 1 Oct. 1964–31 Dec. 1965
Paul F. Bruins, Stanley M. Caulder, and Alvin J. Salkind [1966] 47 p refs
(Grant NGR-33-006-015)
(NASA-CR-71408) CFSTI: HC $2.00/MF $0.50 CSCL 10C

An adiabatic calorimeter was designed and constructed, and a calorimetric technique developed to determine thermal characteristics of electrochemical cells. The validity of the apparatus and method was confirmed by the excellent agreement obtained between the experimentally determined heat of reaction for the nickel-cadmium (KOH) cell, 33.15 Kcal/equiv., and the theoretically accepted value obtained from the literature by voltage measurements 33.15 Kcal/equiv. The heat of reaction for a nickel-cadmium (LiOH) cell was measured and determined to be 37.7 Kcal/equiv. This corresponds to a heat of formation of 157.55 Kcal/mole for the NiOOH-LiOH compound if it is assumed that the change in the heat of reaction was due solely to the heat of formation of the charged nickel hydroxide compound. This change in heat of reaction with variation of electrolyte type indicates that the previously believed independence of the electrochemical system on electrolyte is not completely valid. Author

N66-21749# Union Carbide Corp., Parma, Ohio.
MINIATURE HYDROGEN GENERATOR First Quarterly Report, 1 Jun.–31 Aug. 1965
Jack E. Rothfleisch and Lawrence M. Litz Jan. 1966 64 p refs
Its Rept.-1
(Contract DA-28-043-AMC-01375(E))
(ECOM-01375-1; AD-627337) CFSTI: HC $3.00/MF $0.75

A mathematical analysis was made of the heat and mass balance relations in systems generating hydrogen from combat gasoline, JP-4 and diesel fuel. Processes considered were: (a) high and low pressure steam reforming, (b) high and low pressure partial oxidation, and (c) thermal cracking. In general, JP-4 and gasoline are preferred fuels over diesel fuel in terms of hydrogen generation. Fuel efficiency, based on engineering analysis of typical systems, favors the steam reformer system. Engineering complexity, particularly in terms of miniaturization requirements, indicates the thermal cracking approach may prove the most feasible for construction of miniature hydrogen generators in the range needed to provide hydrogen for 10–200 watt fuel cells. A laboratory thermal cracking apparatus was built and preliminary experiments run. Hydrogen yields up to 3.8 scf per 100 ml. of JP-4 were obtained with a gas product of 93% H_2 and the balance methane. Reaction temperatures in excess of 1100°C were required to give H_2 concentrations above 85%. Above 1000°C, essentially no hydrocarbons other than methane were produced. Combat gasoline gave results similar to JP-4.
Author (TAB)

N66-21810*# Vickers, Inc., Torrance, Calif. Aerospace Div.
DEVELOPMENT OF A HYDROGEN-OXYGEN SPACE POWER SUPPLY SYSTEM Progress Report, 1–30 Sep. 1965
W. D. Morath [1963] 38 p
(Contract NAS3-2787)
(NASA-CR-71517; PR-91570-510-3) CFSTI: HC $2.00/MF $0.50 CSCL 10B

Progress is reported in a program to conduct engineering studies and test work culminating in the design of an auxiliary electric power generation unit. Emphasis is placed on prototype component design and fabrication; performance, friction, and expansion tests; and test equipment. Included are detailed drawings of the piston assembly, piston dome, head inserts, and the cooled cylinder head. Graphs are given for friction mean effective pressure versus speed, various performance parameters, and volume-temperature relationships. C.T.C.

N66-21811*# Vickers, Inc., Torrance, Calif. Aerospace Div.
DEVELOPMENT OF A HYDROGEN-OXYGEN SPACE POWER SUPPLY SYSTEM Progress Report, 1–31 Oct. 1965
W. D. Morath [1963] 38 p
(Contract NAS3-2787)
(NASA-CR-71518; PR-91570-510-4) CFSTI: HC $2.00/MF $0.50 CSCL 10B

Accomplishments are reported in a program leading to the design of a hydrogen-oxygen auxiliary space power generation unit. Emphasis is placed on the design and fabrication of prototype components and engine performance tests. Included are a summary of pertinent test results, heat rejected

versus mixture ratio curves, photographs of oscilloscope pressure time traces, and diagrams of linear pressure versus volume and log pressure versus log volume. C.T.C.

N66-21812*# Vickers, Inc., Torrance, Calif. Aerospace Div.
DEVELOPMENT OF A HYDROGEN-OXYGEN SPACE POWER SUPPLY SYSTEM Progress Report, 1-31 Dec. 1963
W. D. Morath [1964] 51 p
(Contract NAS3-2787)
(NASA-CR-71519; PR-91570-510-6) CFSTI: HC $3.00/MF $0.50 CSCL 10B

Progress is reported on the design, fabrication, and testing of an auxiliary hydrogen–oxygen space power generation unit. Reports are given on the redesign and modifications to such components as the hydrogen valves, oxygen injectors, pistons, cylinders, and compression rings. Significant defects observed during the teardown of Engine No. 1 after 22.2 hours of operation are summarized. All engine failure modes that have occurred to date are listed. A detailed written description of drawing control procedures is included in the appendix. M.R.W.

N66-21813*# Vickers, Inc., Torrance, Calif. Aerospace Div.
DEVELOPMENT OF A HYDROGEN-OXYGEN SPACE POWER SUPPLY SYSTEM Progress Report, 1-30 Nov. 1963
W. D. Morath [1963] 65 p
(Contract NAS3-2787)
(NASA-CR-71520; PR-91570-510-5) CFSTI: HC $3.00/MF $0.75 CSCL 10B

Work accomplished during the period November 1 through November 30, 1963 on the development of a hydrogen-oxygen space power supply system is summarized. Data reported includes such information as the program schedule, engineering studies, design, fabrication, and test results. Plans for instrumentation control, and failure reported are included in the appendix. Tests to be conducted on the NASA SPICE H_2–O_2 engine are outlined. M.R.W.

N66-21877# Radio Corp. of America, Lancaster, Pa. Direct Energy Conversion Dept.
THE DEVELOPMENT OF A LOW-WORK-FUNCTION COLLECTOR FOR THERMIONIC ENERGY CONVERTERS Annual Technical Summary Report No. 3, 1 Nov. 1964-30 Oct. 1965
P. K. Shefsiek and R. J. Buzzard [1965] 121 p refs
(Contract Nonr-4012(00)FBM)
(AD-626444) CFSTI: HC $4.00/MF $0.75

The report covers the full year's work toward the improvement of thermionic energy conversion. This work can be divided into two separate tasks which were concerned respectively with the analysis of special materials to enhance low work function in collector electrodes and the development of a mathematical equation to describe converter performance in terms of physical parameters and conditions. The analysis of materials verified prior work that matrix surfaces delivered improved performance over other electrode surfaces. Of the materials evaluated during the report period, tantalum was superior to tungsten, molybdenum and iridium while nickel was inferior to the three median matrices. The mathematical equation relates output potential to the other parameters of current density, emitter temperature, collector temperature, cesium temperature and electrode spacing. The functional relationships of the converter parameters used in the equations are based on the general theoretical model of thermionic converter operation. The coefficients assigned to each term of the equation are determined by application of linear regression statistical analysis to measured voltage current data. The analysis has been applied to data from several different electrode pairs from different laboratories with excellent correlation with measured data over a wide variation in parameters. Author (TAB)

N66-21977# Atomics International, Canoga Park, Calif.
PERFORMANCE OF A THERMOELECTRIC CONVERTER WITH LEAKAGE CURRENT
A. K. Smith 7 Jun. 1965 17 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-MEMO-11417) CFSTI: HC $1.00/MF $0.50

Expressions relating converter insulation resistance to converter internal resistance, load voltage, and leakage current are derived. Analysis of on line flight test data indicates that converter conductance was increasing at a linear and essentially constant rate of 2.04 millimhos per day subsequent to 651 hours after launch. The performance of the system was calculated on the basis of the following: converter insulation conductance continues to increase at a constant rate equal to that experienced to date and converter open circuit voltage and internal resistance data may be extrapolated on the basis of FS-3 system performance. NSA

N66-22087# Temple Univ., Philadelphia, Pa.
ANODIZED ZIRCONIUM PHOTOVOLTAIC CELLS
Pallessana N. Ramachandran (Ph.D. Thesis) 1 May 1965 104 p refs
(Contract AT(30-1)-2775)
(TID-21971) CFSTI: HC $4.00/MF $0.75

Photoeffects occurring in anodized Zr electrodes at room and liquid-N_2 temperatures are studied. The electrodes are of the type $Zr/ZrO_2/M$ and Zr/ZrO_2/gas phase/M, where M is Sn, Bi, Fe, Cu, Ag, Au, Al, Na, Pb, or, in the Zr/ZrO_2/gas phase/M case, M may be Zr. NSA

N66-22090# California Univ., Berkeley. Lawrence Radiation Lab.
ALPHA PARTICLE BOMBARDMENT OF Si AND GaAs DIODES; ENERGY CONVERSION AND RADIATION DAMAGE
Lawrence D. Posey (Ph.D. Thesis) Jun. 1965 307 p refs
(Contract W-7405-ENG-48)
(UCRL-11958) CFSTI: HC $7.00/MF $1.50

The α-voltaic effect, associated with α-particle stopping in a semiconductor diode, was investigated in p-on-n and n-on-p Si solar cells and p-on-n GaAs solar cells at operating temperatures of 200 and 275°K. An initial maximum conversion efficiency of approximately 4%, well below theoretical predictions, was realized for all three cell types at 200°K and in all cases at 275°K the efficiency was less than 1%. The discrepancy between theory and experiment was attributed to the substantial non-ideal contribution to the dark I-V characteristic present in all the cells employed. The dark I-V characteristics of p-on-n and n-on-p Si solar cells and p-on-n GaAs solar cells were measured for temperatures between 90 and 360°K. The ideal diffusion term was isolated for all the cells, but sheet resistance effects in the surface region were not discernible. The non-ideal current term was found to be more consistent with a junction tunneling current than with a junction recombination-generation current. The GaAs solar cells were found to be the most resistant to radiation damage from a device standpoint while the n-on-p and p-on-n Si cells exhibited decreasing radiation resistance in that order. The diffusion length degradation constants were also determined for

both materials at 200 and 275°K. These values in order of decreasing radiation resistance are, for the p-type Si, $K_p(SI) \approx 3 \times 10^{-5}\,cm^{-2}\,\alpha^{-1}$ at 275° K and $5 \times 10^{-5}\,cm^{-2}\,\alpha^{-1}$ at 200° K, for the n-type Si, $K_n(Si) \approx 7 \times 10^{-5}\,cm^{-2}\,\alpha^{-1}$ at both temperatures, and for the n-type GaAs, $K_n(GaAs) \approx 4 \times 10^{-4}\,cm^{-2}\,\alpha^{-1}$. The dark I-V characteristics of the cells underwent substantial changes during exposure. The changes in the ideal current were consistent with a bombardment induced decrease in minority carrier lifetime. The changes in the non-ideal current term for all the cell types tested were not consistent with a junction recombination-generation current and in fact indicate that a substantial current contribution must be controlled by the surface state of the cells. Author (NSA)

N66-22153# Radio Corp. of America, Lancaster, Pa. Direct Energy Conversion Dept.
THE DEVELOPMENT OF AN IMPROVED THERMIONIC ENERGY CONVERTER Third Quarterly Technical Report
15 Apr. 1965 32 p
(Contract AT(30-1)-3429)
(NYO-3429-3) CFSTI: HC $2.00/MF $0.50

Studies are being made on reservoirless thermionic converters. The feasibility of operating these converters with the envelope at or near the collector temperature was shown. ^{134}Cs was used to fill certain converters to determine the distribution of cesium within the converter and the rate of diffusion in the exposed materials. The reservoirless converters were divided into two groups related to the envelope temperature at pinch-off and during operation. The low-temperature converters were pinched off with the minimum envelope temperature only slightly higher than the optimum cesium reservoir temperature. These converters were characterized by relatively constant power output during their lifetime although they showed a strong sensitivity to envelope temperature. The high-temperature converters were pinched off with average envelope temperatures at least 150°C higher than optimum cesium reservoir temperatures. Their performance was characterized by power outputs relatively independent of minimum envelope temperature. However, a slow reduction in power output during life due to loss of cesium vapor was observed. NSA

N66-22207*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT OF AN ELECTROCHEMICAL ENERGY SOURCE FOR THE MARINER II SPACECRAFT
Charles W. Brooke, Jr. 15 Mar. 1966 61 p refs
(Contract NAS7-100)
(NASA-CR-71772; JPL-TR-32-854) CFSTI: HC $3.00/MF $0.75 CSCL 10B

This Report describes in detail the development of an electrochemical energy source for the Mariner II spacecraft. The data presented trace the development of this battery, beginning with the definition of the electrical and mechanical requirements for the battery and concluding with the telemetered data obtained from the battery during 109 days of spaceflight to Venus. The design changes resulting from the type approval test program on the development model battery and the additional changes dictated by the Mariner II spacecraft system requirements were combined in the final silver-zinc battery design. Author

N66-22328*# TRW Equipment Labs., Cleveland, Ohio.
5KW PULSE WIDTH MODULATED STATIC INVERTER
W. V. Peterson and R. J. Resch 1 Dec. 1965 78 p
(Contract NAS3-6475)
(NASA-CR-54872; TRW-ER-6809) CFSTI: HC $3.00/MF $0.75 CSCL 10B

Design verification tests were performed on logic and low level circuits, and a preliminary single-phase breadboard of a pulse width modulated static inverter was developed which operates at an output power level of 650 watts. A power stage evaluation is made, and the basic operation, transistor, selected configuration, and output filter of the power stage are detailed. Consideration is given to a DC-DC converter, the sizing of reactive current capacitors, and oscilloscope waveforms. Design objectives are given for the 5KW, three phase, 400CPS static inverter, which is to be breadboarded and tested. M.W.R.

N66-22349*# TRW Equipment Labs., Cleveland, Ohio.
MATERIALS MANUAL FOR USE WITH TRW SPACE RADIATOR-CONDENSER DESIGN AND PERFORMANCE ANALYSIS COMPUTER PROGRAMS
Feb. 1966 133 p refs
(Contract NAS9-4884)
(NASA-CR-65330; ER-6756) CFSTI: HC $4.00/MF $1.00 CSCL 10B

Information is compiled to provide a compact reference for the thermophysical properties required in the design of space radiator-condensors. A survey is presented which assesses the utilization of working fluids and materials on actual and proposed space electric power systems employing direct condenser-radiators. The thermophysical properties of candidate working fluids are presented as a function of temperature. These include water, mercury, rubidium, potassium, and three organics: ortho-xylene, ethylbenzene, and Dowtherm-A. The properties of candidate radiator materials are given and materials fabrication compatibility and working fluid compatibility are indicated, along with the meteoroid protection capability of tube and header material. Emittance coatings which would be suitable for extended service in space-vacuum conditions are discussed and solar and thermal absorptivity values are included where available. Coating bonding compatibility with substrates, methods of application, and service temperature limitations are included. Recommendations for further study are made and extensive data tables are appended. E.A.O.

N66-22356*# General Electric Co., Cincinnati, Ohio. Space Power and Propulsion Section.
TWO STAGE POTASSIUM TEST TURBINE Quarterly Progress Report No. 17, May 8-Aug. 8, 1965
E. Schnetzer, ed. 24 Nov. 1965 305 p refs
(Contract NAS5-1143)
(NASA-CR-54897) CFSTI: HC $7.00/MF $1.75 CSCL 10A

The two-stage test turbine designed and fabricated on the contract from the National Aeronautics and Space Administration was successfully performance tested in potassium vapor at temperatures of 1450° and 1550°F. Seventy-two performance data points were obtained within specified tolerances and the evaluation of these results is presented. The performance agreed well with calculated performance and was repeatable. Disassembly of the turbine revealed no significant damage except to the main bearing which was inadvertently deprived of lubricating oil momentarily. No erosion was observed but deposition of containment material constituents occurred on exposed parts. The facility operated stably and suffered no damage. Author

N66-22357*# Douglas Aircraft Co., Inc., Newport Beach, Calif. Astropower Lab.
PROGRAM TO DEVELOP AN INORGANIC SEPARATOR FOR A HIGH TEMPERATURE SILVER-ZINC BATTERY
Quarterly Progress Report, Oct. 29, 1965-Jan. 29, 1966
C. Berger, F. C. Arrance, A. D. Taylor, and A. Himy Mar. 1966 48 p refs
(Contract NAS3-7639)
(NASA-CR-54919; SM-48461-Q2) CFSTI: HC $2.00/MF $0.50 CSCL 10C

Several prototype multiplate five ampere hour cells were fabricated using a modified groove design which emphasizes ease of assembly, positive and adequate closures, parts reproducibility, and filling means. One preliminary multiplate cell successfully completed 1165 cycles at 25°C on a 30 minute discharge, and charge test schedule. Polyphenylene oxide and acetal copolymer were subjected to 1000 hour potassium hydroxide soak tests at 145°C; based on the superior ability of polyphenylene oxide to retain its mechanical properties at this temperature, it was selected as the cover and case material. Cycle testing of unit electrode test cells containing inorganic separators was continued at 100° and 25°C in order to evaluate electrode formulations and configurations; many of the cells successfully completed the required 140 cycles. It is pointed out that, because of promising experimental results thus far obtained, the emphasis of the program was shifted from component testing to multiplate cell fabrication, testing, and evaluation. D.T.

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N66-21205# Argentina. Comision Nacional de Energia Atomica, Buenos Aires.
SIMPLIFIED METHOD FOR LABELLING LIPIDS WITH IODINE-131 [METODO SIMPLIFICADO PARA LA MARCACION DE LIPIDOS CON YODO-131]
Aldo E. Mitta and Marcelo A. Dankert 1965 10 p refs in SPANISH
(CNEA-182) CFSTI: HC $1.00/MF $0.50

A simple procedure is described for labelling triolein, oleic acid, and other lipids with iodine 131. The method combines several previously known techniques resulting in radioactive yields on the order of 90 to 95%. Previous techniques are discussed and the experimental procedures and controls used for the new method are described in detail.
Author (TAB)

N66-21247# Joint Publications Research Service, Washington, D. C.
RECENT OXYGEN STUDIES IN HUMANS AND ANIMALS
A. A. Shurubura et al 24 Mar. 1966 33 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (Moscow), v. 51, no. 12, Dec. 1965 p 1474-1477; 1501-1506
(JPRS-34698; TT-66-31137) CFSTI: $1.00

Adaptation to hypoxia in adult male white rats was accomplished over a month's period. These rates and control rats were tested for frequency and nature of respiration, general motor activity, muscle tonus, and spasmodic twitching of separate muscles or the entire body. The blood content of the skull was examined by [electroplethysmography] for changes from gravitational stress. It was concluded that adaptation to hypoxia increased their resistance to gravitational stress. In a second experiment, white mice were allowed to travel at will through a gas chamber with various gas steps, or mixtures. Humans were permitted to choose various gas mixtures flowing to their respiratory masks. The gas choices were normoxic and hypoxic mixtures of nitrogen-oxygen and helium-oxygen. Both mice and humans were found to prefer helium-oxygen mixtures to nitrogen-oxygen and normoxic to hypoxic mixtures. It was concluded that the helium, due to its low density, increases pulmonary ventilation without increasing the work of the respiratory muscles. N.E.N.

04

N66-21250# Production Group, United Kingdom Atomic Energy Authority, Annon (Scotland). Production Group
THE BIOLOGY OF THE SOLWAY FIRTH IN RELATION TO THE MOVEMENT AND ACCUMULATION OF RADIOACTIVE MATERIAL. III: FISHERIES AND FOOD CHAINS
B. R. H. Williams, E. J. Perkins, and A. Hinde 1965 93 p refs
(PG-611(CC)) HMSO: 14s

The Solway fisheries are described and reasons suggested for recent declines. An account is given of the bottom fauns and food of fish with special reference to the food and biology of flounders and plaice. Primary sources of nutrition are discussed. A marked interspecific competition for food occurred and it is concluded that no one food chain is limiting.
Author

N66-21253# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
SOME CONSIDERATIONS ON THE PROPERTIES OF THE LIVING SYSTEMS [ALCUNE CONSIDERAZIONI SULLE PROPRIETA DEI SISTEMI VIVENTI]
M. Ageno 18 Jun. 1965 34 p refs
(ISS-65/20) CFSTI: HC $2.00/MF $0.50

The present paper summarizes the author's opinion concerning the problem of the possible use of quantum mechanics in describing a living system. The first remark is that a system containing a living being cannot be in a single quantum mechanically defined state. This raises the question if special laws independent of the laws of physics and chemistry are required to describe life: the discussion ends with the conclusion that for the moment we can only try to expand our present system of physical concepts in order to obtain a description of the phenomena of life. Secondly, the limits that we encounter here in the use of conventional chemical concepts are put into evidence as well as the leading role of quantum mechanics. From this point of view, the cell reproduction and how this differs from the process considered by von Neumann are examined. Actual reproduction of a cell is tentatively described as an interference phenomenon occurring in a superposition of states and the importance and meaning of the concept of structure are discussed.
Author

N66-21263# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

PAPERS PRESENTED BY THE PHYSICS LABORATORY AT THE 2nd NATIONAL MEETING ON BIOPHYSICS DEVOTED TO BIOLOGY AND MOLECULAR BIOPHYSICS, ROME, 18-20 JUNE, 1965, PART II [COMUNICAZIONI PRESENTATE DAI LABORATORI DI FISICA AL 2nd CONVEGNO NATIONALE DI BIOFISICA DEDICATO ALLA BIOLOGIA E BIOFISICA MOLECOLARE, ROMA, 18-20 GIUGNO 1965, PARTE II]

20 Jun. 1965 42 p refs In ITALIAN; ENGLISH summary (ISS-65/22) CFSTI: HC $2.00/MF $0.50

Reports include: (1) some studies on the phenotypic suppression of ambivalent phage mutations by streptomycin, and on the main features of this phenomenon; (2) the analysis of the properties of labelled RNA, extracted from spinal ganglia of chick embryos, and the study of the action of the NGF growth factor; and (3) physio chemical studies on the dissociation and structure of Eriphia hemocyanin as observed by means of light scattering, analytical ultracentrifugation and electron microscopy studies. Author

N66-21270# School of Aerospace Medicine, Brooks AFB, Tex.

AN ATLAS OF CROSS-SECTIONAL ANATOMY OF THE *MACACA MULATTA* FOR USE IN RADIOBIOLOGIC EXPERIMENTS

Glenn V. Dalrymple, John J. Ghidoni, Harold L. Kundel, Ian. R. Lindsay, and Melvan D. Jordan May 1965 31 p (SAM-TR-65-32; AD-469874)

To properly perform radiobiologic experiments, a knowledge of the anatomy of the irradiated subject is of greatest importance. Since an atlas of anatomy of the Macaca mulatta is not available and since this animal is very frequently used in radiobiology, this atlas was prepared to implement such experimentation. A 3-kg. female primate cadaver was transversely cut into 25 sections and from these sections color plates were prepared. The atlas can be used to demonstrate depth dose distributions following irradiation. Author (TAB)

N66-21274# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).

THE EFFECT OF X-IRRADIATION ON THE DIVISION CYCLE OF CELLS IN TISSUE CULTURE [DE INVLOED VAN RONTGENSTRALING OP DE DELINGSCYCLUS VAN IN VITRO GEKWEEKTE CELLEN]

D. Bootsma Apr. 1965 98 p refs In DUTCH; ENGLISH Summary (MBL/1965/9) CFSTI: HC $3.00/MF $0.75

The first post irradiation generation cycle of human cells in a monolayer asynchronous tissue culture was studied. By labelling cells with ^{3}H-thymidine minutes it was demonstrated that the generation cycle could be divided into four phases based upon the synthesis of DNA. If a pulse labelling with ^{14}C-thymidine were followed by labelling with ^{3}H-thymidine until fixation, mitoses of cells before, during, and after DNA synthesis could be identified. The influence of irradiation on the entrance of cells into mitosis was studied in synchronous cultures by irradiation at different intervals of time after a second treatment with 7.5 mM thymidine. It was found that mitotic delay is caused by an inhibition of progression in the phase following DNA synthesis. Cells irradiated during this phase were blocked for long periods of time. Cells which were irradiated before and during DNA synthesis were blocked for lesser periods of time. These differences in degree of mitotic delay were found to bring about partial snychronization leading to overshoot of the mitotic index. D.T.

N66-21275# European Atomic Energy Community, Brussels (Belgium). Biology Dept.

EFFECT OF RADIATIONS ON THE DETOXICATION OF α-METHYLNAPHTHALENE [EFFETTO DELLE RADIAZIONI SULLA DETOSSICAZIONE DELL' α-METILNAFTALENE]

P. Scoppa and K. Gerbaulet 1966 16 p refs In ITALIAN; ENGLISH summary Presented at the 34th Gen. Assembly of the Italian Soc. of Exptl. Biol., Sorrento, Italy, 30 Sep.-2 Oct. 1965 (EUR-2628.i)

In the rat, the increase in the excretion of glucuronides induced by the oral administration of α-methlnaphthalene was found to be reduced by half if the animal were previously X-irradiated. Some of the possible causes are examined and discussed. Author

N66-21277# European Atomic Energy Community, Brussels (Belgium). Biology Dept.

GLUCORONIDE EXCRETION IN THE URINE OF IRRADIATED RATS [ESCREZIONE DI GLUCURONIDI URINARI NEL RATTO IRRADIATO]

P. Scoppa and K. Gerbaulet Feb. 1966 13 p refs In ITALIAN; ENGLISH Presented at the 34th Gen. Assembly of the Italian Soc. of Exptl. Biol., Sorrento, Italy, 30 Sep.-2 Oct. 1965 (EUR-2638.i)

The urinary excretion of total glucuronides is strongly reduced in the rat exposed to sublethal X-irradiation. The decreases of urinary glucuronides are examined and compared with those found in paired fed controls. Author

N66-21280# United Kingdom Atomic Energy Authority, Harwell (England). Authority Health and Safety Branch.

ENVIRONMENTAL MONITORING ASSOCIATED WITH DISCHARGES OF RADIOACTIVE WASTE DURING 1964 FROM U.K.A.E.A. ESTABLISHMENTS

Nov. 1965 35 p refs (AHSB/RP/-R-66)

The results are given of an environmental monitoring program to confirm that the discharges of radioactive waste during 1964 from each of the principal EKAEA establishments produced no hazard in the environment. These results are summarized and are compared with derived working limits to facilitate an appreciation of the standards of safety achieved. Author

N66-21286# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio

BIOCHEMICAL AND PHYSIOLOGICAL EVALUATION OF HUMAN SUBJECTS WEARING PRESSURE SUITS UNDER SIMULATED AEROSPACE CONDITIONS Final Report, Aug. 1963-Jun. 1966

K. J. Smith, E. W. Speckmann, Marilyn E. George, G. M. Hemm, and D. Wiltsie Dunco (Miami Valley Hosp. Res. Dept.) Oct. 1965 50 p refs (AMRL-TR-65-147; AD-626619) CFSTI: HC $2.00/MF $0.50

A series of experiments has been designed to determine the water, energy, and protein requirements of man under various simulated aerospace conditions. The experiment described measured the effects of wearing a MA-10 pressure suit continously for 14 days on the aforementioned measurements. A freshly prepared diet that closely matched proposed aerospace diets was fed to four human volunteers and coefficients

of apparent digestibility and balances of the component nutrients were determined. The results showed that the wearing of unpressurized MA-10 suits under ambient conditions for 14 days did not affect the subjects' fluid intake and output. No significant changes were observed in digestibilities or balances of the nutrient components. Results indicated that the fresh food diets was very efficiently utilized. No significant changes in subject blood pressures, oral temperatures or pulse rates were observed during the experiment. All hematological and chemical analyses of blood were within the normal range and did not exhibit differences between experimental periods. The 2 day menu of fresh foods proved to very acceptable and did not decrease in acceptability during the 42 day experiment.
Author (TAB)

N66-21322# Naval Radiological Defense Lab., San Francisco, Calif.
BONE MARROW AS THE MAJOR SOURCE OF POTENTIAL IMMUNOLOGICALLY COMPETENT CELLS IN THE ADULT MOUSE
Marvin L. Tyan and Leonard J. Cole 8 Dec. 1965 12 p refs
(USNRDL-TR-946; AD-626682) CFSTI: HC $1.00/MF $0.50

Groups of F1 hybrid mice (A×B) were sublethally irradiated and injected with cells from various lymphoid tissues of adult parental strain (A) mice. Spleen and lymph node cells and cells from the thymus of the survivors were then injected into an F1 hybrid of another type (A×C). A significant number of deaths occurred among the secondary hosts only when they had received spleen cells from mice which had been injected with adult bone-marrow cells.
Author (TAB)

N66-21402# Aktiebolaget Atomenergi, Stockholm (Sweden).
TRACE ELEMENTS IN HUMAN MYOCARDIAL INFRACTION DETERMINED BY NEUTRON ACTIVATION ANALYSIS
P. O. Wester May 1965 39 p refs
(AE-188) CFSTI: HC $2.00/MF $0.50

A recently developed ion-exchange technique, combined with subsequent γ-spectrometry, is used. The following trace elements are determined: Ag, As, Au, Ba, Br, Ca, Cd, Ce, Co, Cr, Cs, Cu, Fe, Hg, La, Mo, Rb, Sb, Sc, Se, Sm, Zn and W. In the injured tissue compared to the uninjured, calculation on a wet weight basis showed a decrease in Co, Cs, K, Mo, P, Rb and Zn, and an increase in Br, Ca, Ce, La, Na, Sb and Sm. The differences in Ca, La, Mo, P and Zn are dependent on the age of the myocardial infarction, and the regression lines for these elements are given. The concentration of the trace elements in uninjured tissue from infarcted hearts is compared to the concentration of these elements in normal heart tissue, determined in a previous study. In the uninjured tissue from infarcted hearts a decrease is found in Cu and Mo, and an increase in As and Ce.
Author

N66-21406# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF GENERAL CHILLING AND HIBERNATION ON THE RESTORATION OF VITAL FUNCTIONS IN ANIMALS AFTER CLINICAL DEATH DUE TO ACUTE LOSS OF BLOOD
V. I. Soboleva 28 Sep. 1965 20 p refs Transl. into ENGLISH from Patol. Fiziol. i Eksperim. Terapiya (Moscow), v. 6, no. 1, 1962 p 28-33
(FTD-TT-65-874/1; AD-622350)

Conclusions: If the terminal state in the animal develops against a background of hibernation of combined hibernation and hypothermia, subsequent restoration of the vital functions by means of arterial infusion is difficult, and even becomes impossible in a number of cases. Lowered or nullified effectiveness of arterial blood infusion on development of the terminal state under the conditions of hibernation can be accounted for by inactivation of the nervous mechanisms regulating the cardiovascular system under the influence of the neuroplegic preparations. The detrimental effect of the hibernation mixture might also be linked to an aggravating effect of the lytic preparations on the profound inhibition of the central and vegetative nervous systems that prevails in extreme stages of mortification, with the result that the resuscitation process becomes more difficult.
Author (TAB)

N66-21412# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INCREASE IN THE EXTENSOR TONUS IN CATS WITH FULLY AND PARTIALLY EXCISED CEREBELLUM DURING WEIGHTLESSNESS
O. G. Gazenko, R. A. Grigor'yan et al 20 Oct. 1965 21 p refs Transl. into ENGLISH from Byull. Eksptl. Biol. i Med. (Moscow), v. 60, no. 7, 1965 p 7-12
(FTD-TT-65-1554/1+2+4; AD-623272)

Two cats, one with partially excised cerebellum and the other with fully excised cerebellum, were observed for their late and motor reactions in weightlessness during parabolic flights. The vestibular status of the animals was studied by photographic recording of their lifting reflexes of the head and extremities, their readiness to jump, as well as their turning and adjusting reflexes. Cats with fully or partially excised cerebellum showed extensor rigidity of the trunk, neck, rear extremities, and especially the front extremities for the duration of the weightlessness state that much exceeded analogous tonus changes in control animals. Similar symptoms in normal animals were expressed to a lesser degree and disappeared with adaption to the weightlessness condition.
G.G.

N66-21421# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
MICROBIOLOGIC SAMPLING FOR HUMAN SUBJECTS
Arselus West Dec. 1965 25 p refs
(AMRL-TR-65-192; AD-627928) CFSTI: HC $1.00/MF $0.50

The restricted environment of a space vehicle and the stresses of space flight have made necessary the establishment of microbiologic tolerance limits. A graphic outline is presented for the microbiologic sampling of human subjects to determine the composition of their indigenous microflora. The types of microorganisms to be expected and the culture media to be used are given for various body areas.
Author (TAB)

N66-21489# Air Force Systems Command, Kirtland AFB, N. Mex. Air Force Weapons Lab.
EFFECTS OF RADIATION ON SOME SERUM ENZYMES AND TRACE ELEMENTS IN LARGE ANIMALS Technical Summary Report, 1 Apr. 1962-7 Jun. 1965
William S. Riggsby, Norman D. Jones, and William R. Godden Jan. 1966 38 p refs Prepared in cooperation with Omaha Veterans Admin. Hosp.
(Contract AF 29(601)-62-5217)
(AFWL-TR-65-112; AD-627862) CFSTI: HC $2.00/MF $0.50

This report summarizes the results of determinations of serum zinc, copper, malic dehydrogenase (MDH), lactic dehydrogenase (LDH), glutamicoxalacetic transaminase (SGOT), and glutamicpyruvic transaminase (SGPT) in large mammals following various types and doses of radiation. The principal subjects were mature sheep although beagle dogs and 'miniature' swine were also used. The radiation sources were a

cobalt-60 teletherapy unit, a 250-kvp X-ray therapy unit, and a Godiva II pulsed fission-spectrum neutron reactor. Results indicate that the quantity and type of irradiation received by these animals cannot be determined from these parameters. Author (TAB)

N66-21582# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RADIOBIOLOGICAL EFFECTS IN ANIMALS PREVIOUSLY SUBJECTED TO ACCELERATION

B. I. Davydov, V. V. Antipov, N. I. Konnova, and P. P. Saksonov *In its* Cosmic Res., Vol. 3, No. 5 20 Jan. 1966 p 203–215 refs (See N66-21566 11-30) CFSTI: HC $6.00/MF $1.25

The reaction of mice to ionizing radiation after preliminary subjection to acceleration was studied. Evaluation of the lethality curves by the probit method indicated that on combined application of acceleration and irradiation the $DL_{50/30}$ is approximately 100r higher than after irradiation alone. However, the average survival time of the animals that perished after irradiation with a dose of 750r (during 30 days of observation) was shorter if they had been first subjected to acceleration. The difference in the average weights of the spleen and thymus of irradiated animals that had been accelerated was statistically unreliable. However, the coefficients of variation of the weights of these organs were higher on the 3rd, 7th, and 15th days after irradiation in the animals that had been irradiated after centrifuging. Radiation leucopenia was less distinct when both acceleration and ionizing radiation were administered. The possible mechanisms of the modifying action of acceleration in radiation injury to the animals are discussed. Author

N66-21583 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INFLUENCE OF CERTAIN SPACEFLIGHT FACTORS ON THE HEREDITARY STRUCTURES OF MAMMALS

M. A. Arsen'yeva, L. A. Belyayeva, Yu. S. Demin, G. L. Pokroyskaya, A. V. Golovkina et al *In its* Cosmic Res., Vol. 3, No. 5 20 Jan. 1966 p 216–234 refs (See N66-21566 11-30) CFSTI: HC $6.00/MF $1.25

The effects of vibration and acceleration (of varying duration and intensity), and the combined action of these factors with radiation on the hereditary structures of mammals were studied. It was shown that such dynamic factors as vibration and acceleration cause certain disturbances in the nuclei of bone marrow and spleen cells, and modify the effect of radiation when it is combined with other factors. Author

N66-21606# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EARLY DIAGNOSIS OF ACUTE RADIATION SICKNESS Selected Articles

S. N. Ledanova, ed. 18 Oct. 1965 245 p refs Transl. into ENGLISH from the book "K Voprosam Ranney Diagnostiki Ostroy Luchevoy Bolezni," Kiev, Gos. Med. Izd-Vo USSR, 1962 p 1–4, 16–28, 62–94, 103–139, 147–168, 174–232 (FTD-TT-65-589/1+2; AD-625779) CFSTI: HC $6.00/MF $1.25

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N66-21607# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STUDY OF EARLY CHANGES IN BLOOD PROTEINS BY THE POLAROGRAPHIC METHOD FOLLOWING WHOLE-BODY IRRADIATION

E. M. Momotyuk *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 1–10 refs (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

Polarographic analyses were used to study changes in the total number of sulfhydryl and disulfide groups in the blood proteins of white rats following irradiation, and to evaluate the occurrence of more profound oxidative reactions than the transformation of -SH to -S-S- protein groups. This method consists of finding the concentration point at which the protein waves are of equal height, and the characterization of this point of wave equality (PWE) by both its height and protein concentration. These indices are dependent only on protein structure. It was found that the change in thiol and disulfide immediately after irradiation is not related protein fraction, and it is assumed that secondary compensatory responses in the organism result in the reduction of previously oxidized thiol and disulfide groups. It is further assumed that some structural changes occur in the organism's proteins following irradiation, and that there are also changes in the separate functional groups in the protein molecules. M.W.R.

N66-21608# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STUDY OF SORPTION PROPERTIES OF SERUM PROTEINS IN THE EARLY STAGES OF EXPERIMENTAL RADIATION INJURY

L. A. Frenkel' *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 11–19 refs (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

A study was undertaken to determine energy-structure modifications in the surface structures of the serum protein complex following exposure to ionizing radiation and to detect any changes in protein sorption properties during actual development of dose-dependent radiation damage. To accomplish this, rabbits were subjected to single whole-body irradiation doses of 200 and 800 r. Data presented indicate that statistically significant disturbances in the stability of serum protein surface structures begin within a few hours after irradiation and continue for an entire month. A definite correlation was found between observed disturbances and radiation dose, both in the nature of the processes and in the absolute values of the stability changes. It is believed that these energy-structure disturbances are among the early physicochemical responses to radiation, and these changes in the sorption properties of the serum proteins which accompany radiation sickness may have possible use as in diagnostic procedures. M.W.R.

N66-21609# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE DYNAMICS OF HISTOCHEMICAL AND MORPHOLOGICAL CHANGES IN THE INTERNAL ORGANS OF ANIMALS DURING THE EARLY STAGE AFTER WHOLE-BODY X-RAY IRRADIATION

I. M. Peysakhovich, Ya. M. Telengater, and P. Ya. Sologub *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 20–43 refs (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

Cytochemical and structural changes in nucleoproteins in the spleen and mucous membrane of the small intestine are found to occur within 10 to 30 minutes after white rats are exposed to large doses (900 to 1000 r) of X-rays. Changes in the liver are of a smaller order. Decrease in DNA and RNA content and mucous membranes occurs later and at a slower rate with doses of 500 r. Other changes noted for large radiation doses are: (1) an immediate increase in phosphatase activity which is followed by a decrease, (2) a rapid disappearance of ascorbic acid in the adrenal glands, (3) decrease in sulfhydryl groups in the liver and spleen, and (4) and a decrease in glycogen content in liver cells. These various disturbances which develop in the early stages following large-dose irradiation indicate that numerous pathological processes weaken the reactivity of the organism and produce radiation sickness. M.W.R.

N66-21610# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CHANGES IN NITROGEN METABOLISM DURING ACUTE EXPERIMENTAL RADIATION SICKNESS INDUCED BY THE ADMINISTRATION OF RADIOACTIVE PHOSPHORUS

M. Ya. Boyarintseva *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 44–51 refs (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

Nitrogen metabolism during radiation sickness resulting from internal doses of radioactive phosphorus is investigated in rabbits by studying blood proteins, residual nitrogen, and urea in the blood plasma and total nitrogen, urea, and ammonia in the urine. It was found that a single subcutaneous administration of 2.5 microcuries/kg produced acute radiation sickness, which was accompanied by an increase in all the blood plasma measurements. An increase in the urine measurements occurred during the course of radiation sickness. These findings confirm the opinion that intensified decomposition of proteins occurs during acute radiation sickness. M.W.R.

N66-21611# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PROBLEM OF HEAT AND GAS EXCHANGE DURING ACUTE RADIATION SICKNESS

G. A. Levchuk and V. S. Bogdanovich *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 52–68 refs (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

Rabbits and dogs were subjected to various radiation dosages in a study of heat and gas exchange during acute radiation sickness. Within 30 minutes after exposure to 450, 650, and 900 r, most rabbits exhibited increased temperature; femoral muscle and rectal temperatures increased about 1.1°C, while skin and mucous membranes of the upper respiratory tract about 1.5°C. These increases were accompanied by a considerable quickening of respiration and pulse and a dilatation of peripheral vessels. A regular pattern of temperature reduction was observed on the second day after radiation exposure; by the third to fifth days, for each of the dosages, temperatures dropped to initial or lower values. At doses of 900 r, some of the rabbits exhibited temperature drops either immediately or within three hours; for these animals, shock-like reactions developed and death usually followed. A clear dependence on radiation dose was noted in the study of thermatopography and basal metabolism in dogs. Basal metabolism reached its highest rate during the climax of radiation sickness; and temperatures and metabolism returned to normal during recovery. M.W.R.

N66-21612 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EARLY CHANGE IN THE BLOOD DURING ACUTE RADIATION SICKNESS IN RATS

Sh. A. Burshteyn *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 67–77 refs (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

White rats were subjected to single whole-body irradiation ranging from 150 to 1200 r in order to determine various blood indices. A leukopenic reaction of the blood is common to all the dosages, and leukocyte count drops one hour after irradiation between 33 and 40% for the various dosages. There appears to be no direct correlation between this blood index and the severity of radiation sickness. More drastic reduction in leukocyte counts occurs with time, and it is concluded that a serious leukopenic condition sets in as early as 24 hours after irradiation. No relationship was established between changes in quantity of lymphocytes and strength of radiation dose; lymphopenia developed and increased during the periods following irradiation for all the dosages given. Blood smears of the experimental rats revealed giant hypersegmented neutrophils, vacuolization of the nucleus and protoplasm of the cells, cytolysis, lysis, pycnosis of the nucleus, granularity in the protoplasm of neutrophils, lymphocytes with division of the nucleus, and very small forms of lymphocytes and neutrophils. M.W.R.

N66-21613 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CHANGE IN THE DIAMETER OF ERYTHROCYTES DURING THE EARLY PERIOD OF ACUTE RADIATION SICKNESS

Sh. A. Burshteyn and N. A. Tsybenko *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 78–86 refs (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

Experiments with female white rats indicate that whole-body X-ray irradiation causes a decrease in the diameter of erythrocytes during the early stages of radiation sickness. The time of onset of microcytosis is generally dependent upon the radiation dose. For absolutely lethal doses, smaller diameters are seen after 24 hours, whereas with smaller doses the same changes do not begin until 48 or 72 hours. It is assumed that the change in diameter of erythrocytes during radiation injury is affected by factors associated with the cells themselves, the ambient medium, condition of the blood system, and impairment of the nervous system. Qualitative changes in erythrocytes were also observed, and these changes are considered early indicators of functional inadequacy of the red blood cells during radiation sickness. M.W.R.

N66-21614 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF BLOOD LOSS ON CHANGES IN THE PERIPHERAL BLOOD DURING RADIATION SICKNESS

V. F. Cherkasov *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 87–99 refs (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

Leukocyte count in the peripheral blood of cats subjected to both whole-body X-ray irradiation of 400 r and blood loss was found to be somewhat higher than for those exposed to the radiation alone. The difference was clearly shown beginning with the fifth day following exposure, and it is assumed that the leukopoietic function of the hemogenetic system is preserved somewhat longer by the combined effect. A reduction in the number of erythrocytes is noted one day after irradiation, and this is followed by an increase on the fifth day and a more or less significant reduction by the 10th day. When subjected both to irradiation and blood loss, there is a loss in number of erythrocytes which begins on the first day and continues through the 15th day. Changes in amount of hemoglobin correspond the erythrocytes changes for both groups. While there is a higher survival rate for animals that are subjected to both irradiation and blood loss, this difference cannot be explained by changes which occur in the blood. M.W.R.

N66-21615 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CHANGES IN THE REACTIVITY OF THE BLOOD SYSTEM DURING RADIATION SICKNESS

Ye. I. Komarov *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 100–117 refs (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

The distortion in leukocyte reactions during radiation sickness, even when leukopenia has not yet developed, is considered of value as a diagnostic tool. The combination of an increase in eosinophil number and leukopenic reaction can serve as a good indicator of radiation sickness as well as a test for determining the function of the hypophyso-adrenal system following ionizing radiation exposure. Whole-body X-ray irradiation of cats brought about clear changes in alimentary reaction during the first two days, either the absence of alimentary leukocytosis or a decrease in leukocyte count. By the end of one month of radiation sickness unstable leukocyte reactions were noted; there was rapid alternation of leukocytotic and leukopenic phases as well increased leukocyte reactions; stable normal alimentary reactions were not restored until the sixth or seventh month after irradiation with 16 to 19 r/min in air at a distance of 60 cm. A total dose of 300 r caused death in 15 to 20% of the animals within a month following exposure. Studies were made of the effect of milk and adrenalin injections on leukocyte reactions, from which it was concluded that the leukocyte reactions following radiation are not significantly related to the sensitivity of the mechanoreceptors of the stomach. M.W.R.

N66-21616 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

REACTION OF THE WHITE BLOOD CELLS TO GLUCOSE INJECTION WITH MULTIPLE IRRADIATION

I. V. Remizova *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 118–126 refs (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

In rabbits subjected to multiple X-ray irradiation over prolonged periods of time, at a single dosage rate of 3.33 r/min, a 5ml intravenous injection of 40% glucose solution produces changes both in intensity and character. Periods of intensified reaction alternate with periods of diminished reaction. Sometimes a leukopenic reaction is observed in which leukocyte count remains below the initial value. It is concluded that a sharply intensified leukocyte reaction accompanied with marked leukopenia may indicate a continuing, although altered, capacity of the blood system to react to a given stimulant. It is also noted than an intensified leukocyte reaction is often accompanied by a low leukocyte count, and that the reaction of irradiated animals to the glucose does not present a constant picture. M.W.R.

N66-21617 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

COAGULABILITY OF BLOOD AND BRITTLENESS OF CUTANEOUS VESSELS IN THE EARLY STAGES OF ACUTE RADIATION SICKNESS IN RATS

A. K. Arnautov *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 127–137 refs Presented at the Sci. Conf. of the Kharkov Inst. of Med. Radiol., 30 Dec. 1957 (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

Blood coagulability of the cutaneous vessels in rats is found to slow down within one hour after whole-body X-ray irradiations of between 150 and 1500 r. Some relationship between coagulation and dose size is reported during the first three days after exposure; for doses of 600 r and below, there is an increase of 1.75 to 2.2 times the initial level after 72 hours; for doses of 750 r and greater the increase, which is more gradual, reaches three to four times the initial value at the end of three days. Brittleness of subcutaneous vessels is lowered during the first three to four days after exposure for all of the dosages; an increase in brittleness is reported to occur sooner for the higher than lower dosages. At doses of 750 r and greater, the hemorrhagic syndrome does not begin to develop until the fifth to seventh day following exposure which is after the period of nerve-reflex disturbances of the vascular tone has ended and after coagulation has returned to its initial value. M.W.R.

N66-21618 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EARLY CHANGES IN CHRONAXIA AND ACCOMMODATION IN ANIMALS WITH ACUTE RADIATION SICKNESS

I. A. Kogan *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 138–151 refs (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

Chronaxy in irradiated rats appears to be more related to time than to dosage; and changes, which usually occur within an hour after exposure, take the form of lengthening of chronaxy and increasing the accommodation parameter. Such changes are considered to indicate deterioration of the functional properties of the nerves. In both rats and rabbits, a two-phase change is observed in the nerves. Small doses, 100 and 200 r, produce a deterioration of functional properties; doses of 400 and 800 r produce a certain normalization in the index of chronaxy as well as improvement in accommodation; and there is a renewed degree of deterioration from larger doses. It is suggested that small doses affect the central nervous system; increasing doses may lead to excessive inhibition of the centers and less effect on the periphery; further increase may have a direct effect on the peripheral motor nerves to cause additional deterioration. M.W.R.

N66-21619 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF IONIZING RADIATION ON THE FUNCTIONING OF THE GASTROINTESTINAL TRACT DURING EXPERIMENTATION

Ye. A. Brodskaya *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 152–158 refs (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

Four dogs with Basov's fistula were used to study functioning of the stomach and small intestine under conditions of subacute radiation sickness, both when clinical symptoms were manifested and after recovery. Investigations made over periods of between eight and 16 months after radiation exposure indicated that the sharpest disturbances in the functioning of the gastrointestinal tract were observed after the disappearance of clinical symptoms when the blood indices returned to their initial values. Both in the latent period and when leukopenia and lymphopenia are at a maximum, the gastrointestinal tract appears to function better than during the period of clinical well-being. It is further found that the functioning of the stomach and small intestine were more impaired during the first hour of gastric secretion following exposure than the second. M.W.R.

N66-21620 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HISTOCHEMISTRY OF NUCLEIN EXCHANGE IN THE BLOOD-FORMING ORGANS OF ANIMALS DURING ACUTE RADIATION SICKNESS

O. M. Nosalevich and G. S. Kolesnikova *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 159–170 refs (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

Changes in DNA and RNA were studied during acute radiation sickness in rats exposed to single whole-body X-ray doses between 450 and 1200 r. The rats were decapitated at one, 24, 48, and 72 hours after irradiation; and the presence of radiation sickness was confirmed by the appearance of the animals, body weight loss, pathological and anatomical dissection data, and changes in blood and blood-forming organs. Morphological changes in the spleen are apparently related to dosage size; for large doses, RNA content decreases more markedly during the 72-hour period than does DNA content; at smaller doses, DNA content hardly changes, whereas RNA decreases in an undulating manner. With doses of 1050 and 1200 r, DNA decrease in bone marrow is considerably less pronounced than the decrease in quantity of cell elements; with smaller doses, no DNA decrease is reported and RNA increases considerably. A study increase in DNA content of the lymph nodes is observed for all dosages. At 450 and 900 r, the follicles of the spleen exhibit both destructive changes and regenerative processes. M.W.R.

N66-21621# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MORPHOLOGICAL AND HISTOCHEMICAL CHANGES IN THE TISSUE OF THE ADRENALS DURING ACUTE RADIATION SICKNESS

O. M. Nosalevich and G. S. Kolesnikova *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 177–189 refs (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

A change in the weight of adrenal glands and a decrease in the quantity of cholesterol and sudanophilic fat is observed during the first three days of exposure of rats to single whole-body X-ray irradiation in doses of 1200, 1050, and 900 r. The changes which occur indicate intensified activity of the hormones as well as wasting of the adrenal cortex. As radiation dose is increased there is an accompanying drop in the content of the nucleic acids in the adrenal glands. Functional reactions in the adrenals appear immediately after irradiation, while morphological changes do not occur until later. M.W.R.

N66-21622 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MORPHOLOGICAL CHANGES IN SUDDEN DEATH FROM RADIATION AND DEATH FROM SO-CALLED RADIATION SHOCK

L. V. Funshteyn and P. V. Sipovskiy *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 190–203 refs (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

Rabbits and guinea pigs were studied following large doses of X-ray irradiation in order to identify the phenomena which cause sudden death from radiation sickness. Some of the animals died during irradiation, while others lived as long as 12 days. It is noted that as the lifetime of the exposed animals increases, leukocyte count in the various organs drops; within 3.5 to 12 days after radiation, leukocytes are

no longer detected. Various tissue elements reacted differently to the radiation effects. In cases of early death, dissections revealed congested plethora of the vessels and hemorrhages of the blood-forming and parenchymatous organs. Similar findings resulted with animals that died during exposure; for these, multiple hemorrhages in the lungs were generally detected. There was a similarity of such changes as well as in bone marrow and lymph nodes of animals who died at various intervals following exposure. Microscopic changes in internal organs did not generally vary either. M.W.R.

N66-21623 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON METHODS OF EXPERIMENTALLY PRODUCING ACUTE RADIATION SICKNESS

V. I. Kulinskiy *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 204-212 refs (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

Dose distribution over the irradiation field, determination of the surface dose, and the qualitative characteristics of radiation are discussed in connection with the experimental production of acute radiation sickness. Specifications are developed which permit the standardization of procedures for inducing acute symptoms in rabbits by using a one-tube apparatus. Under the proposed conditions, X-ray irradiation with 196 kv and filters of 0.5 mm Cu and one mm Al has a first half-value layer of 1.08 mm Cu and a second of 1.7 mm Cu. M.W.R.

N66-21624 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CYLINDER AND FLAT PROPORTIONAL COUNTERS, THEIR INVESTIGATION AND APPLICATION

M. N. D'yachenko *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 213-227 refs (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

Extremely small quantities of radium and other radioactive substances in the human organism can be determined by measuring the alpha activity of the blood and urine. The cylindrical and flat proportional counters used for this purpose can also be applied to measuring the concentrations of alpha-active substances and other radioactivity in the atmosphere. Such counters, which have large active surfaces and a small background, operate stably in the same way as neutron detectors and dosimeters. There are layers of boron on the inside and surfaces. Design of these counters is discussed; along with the influence of the photoeffect, electronegative molecules, and space charges on gas amplification. M.W.R.

N66-21680*# Maryland Univ., Baltimore. Psychiatric Inst.

MOLECULAR BINDING IN THE CELL SURFACE Progress Report, Period Ending 31 Dec. 1965

Robert G. Grenell [1965] 20 p refs

(Grant NGR-21-002-040)

(NASA-CR-71544) CFSTI: HC $1.00/MF $0.50 CSCL 06A

Detailed are salient constructional features of a microwave absorption cavity, derived from Vogelhut, to be used in proposed bound-water experiments with neuroproteins. Adaptations of existing hardware are indicated where they have been applied. An improved klystron oscillator system is proposed, and the instrumentation for digitalized readout of cavity characteristics is discussed. Appended are approximate costs and a suggested schedule for experimental stages in the proposed investigation. Briefly discussed are the applications of current techniques in NMR and Electron Paramagnetic Resonance Spectroscopy to molecular characteristics of membrane protein and protein residues. The tentative evaluation indicates the microwave techniques as the most promising of the current spectroscopic procedures for elucidating charged relationships and binding-site activity for a variety of orientations of the macromolecule. Hence, the construction of the absorption cavity and its initial use in an existing microwave system was proposed. Author

N66-21681*# California Univ., Berkeley. Space Sciences Lab.

BASE COMPOSITION OF INTACT NUCLEIC ACID OLIGOMERS

Stanley Mandeles and Charles R. Cantor [1966] 24 p refs Submitted for Publication

(Grants NsG-479; NIH-GM-12158-02)

(NASA-CR-71555) CFSTI: HC $1.00/MF $0.50 CSCL 06A

The base composition of intact, purified, oligonucleotides was determined by comparing the absorption spectrum of each oligomer with calculated curves. The spectral curve of each oligomer was measured in 7 M urea at three pH values and digitized at 1 μ intervals. The calculated curves consisted of the sums of the absorption spectra of mononucleotides in 7 M urea at the same pHs. A computer was used to make the comparisons and establish the best fit. Results are presented for nine of the ten possible dimer composition isomers; trimers from pancreatic and T_1 Ribonuclease hydrolysates of TMV-RNA; poly-A, poly-C, and poly-U; and intact tobacco mosaic virus-RNA. Author

N66-21682*# California Univ., Los Angeles. Space Biology Lab.

CENTRAL NERVOUS, CARDIOVASCULAR AND VISUOMOTOR STUDIES RELATING TO SPACIAL ORIENTATION IN A 30-DAY PRIMATE FLIGHT

W. R. Adey [1966] 40 p refs

(Grant NsG-502)

(NASA-CR-71556) CFSTI: HC $2.00/MF $0.50 CSCL 06S

An experiment is described for the monitoring of sensory, motor, and higher nervous functions that relate to visual coordination, spacial orientation, recent memory, and discriminative ability in prolonged space flight. A 6.8 kg monkey, *Macaca nemestrina*, will be tested in two behavorial tasks involving delayed matching-to-sample, and an eye-hand coordination test. Techniques for central nervous, cardiovascular, peripheral nervous, and autonomic monitoring during the thirty day primate flight in Biosatellite D are discussed. Environmental support includes an oxygen-nitrogen gas system, reward and *ad libitum* pellet feeding, and water from the fuel cell power system. Data acquisition and analysis techniques are reviewed. Relative to the experiment, central nervous mechanisms underlying orienting and visual discriminative functions are discussed and interrelations of vestibular and optic sensory influxes with cortico-diencephalic and limbic mechanisms as essential substrates for spatial orientation are reviewed. E.A.O.

N66-21744# Technisch Documentatie en Informatie Centrum Voor de Krijgsmacht, The Hague (Netherlands).

SURVEY OF LITERATURE ON MILITARY MEDICINE [LITERATUUROVERZICHT MILITAIRE GENEESKUNDE]

15 Feb. 1966 28 p refs In DUTCH, ENGLISH, FRENCH and GERMAN *Its* Vol. 12, No. G-127

CFSTI: HC $2.00/MF $0.50

Contains abstracts and bibliographic notes on atomic-biologic-chemical warfare, psychology and psychiatry, air

flight medicine, internal medicine, surgery, pharmacology and toxicology, radiology, and medical news. Transl. by J.O.

N66-21763# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INFLUENCE OF ROTATION TRAINING ON MOTOR CONDITIONED REFLEXES IN RATS

S. I. Nudman 5 Nov. 1965 16 p refs Transl. into ENGLISH from Zh. Vysshei Nervnoi Deyatel'nosti (Moscow), v. 14, no. 5, 1964 p 885–891
(FTD-TT-65-969/1+2; AD-627853) CFSTI: HC $1.00/MF $0.50

Experiments were conducted to determine the influence of preliminary rotation on an induced system of two motor conditioned reflexes. In the investigation mature white rats, trained to run left on presentation of an auditory signal and right on a visual signal, were rotated clockwise in a centrifuge at 60 rpm for five 12-min sessions with intervals of 1 min between sessions. Immediately after rotation, the animals were placed in the maze. In analyzing the results, it was found that rotation materially influenced higher nervous activity. Findings showed an increase in erroneous reactions, a decrease in absolutely correct and signal reactions, and a prolongation of latent period and maze-running time. There were also indications that the disruptions were more pronounced with the conditioned auditory signals than with the visual signals. M.G.J.

N66-21796# Academy of Sciences (USSR), Moscow.

METHODS AND SOME RESULTS OF MICROBIOLOGICAL INVESTIGATIONS OF METEORITES

S. S. Abyzon and A. A. Imshenetsky 1964 13 p Presented at the COSPAR Symp., Florence, May 1964

Microbiological investigations were conducted on rock and meteorites to determine the possibility of the existence of microorganisms in meteorites. The experiment box consisted of two hermetic chambers with observation windows and openings for rubber gloves and a boring device. The laboratory equipment, tools and flasks with nutrient media were placed in the box and the unit sterilized. Two preliminary experiments were conducted on rocks, sterilized and then either placed in soil, or having soil and nutrient inserted in a bored channel. Microbiological analysis showed that bacteria from the soil had penetrated throughout the rock. Channels were then bored in meteorites and soil inserted as above. It was determined that bacteriological cells permeated the Sikhote-Alin iron octahedrite, Kunashak stone chondrite, and Saratov stone chondrite meteorites. The Chinge iron otoxite was found to be impermeable to cells and also to air. It was concluded that microbiological studies of meteorites which had lain in soil for some time could give erroneous results. N.E.N.

N66-21800# Joint Publications Research Service, Washington, D. C.

UTILIZATION OF RADIOTELEMETRY FOR THE STUDY OF GASTRIC AND INTESTINAL TEMPERATION IN MAN

Ye. B. Babskiy, B. Ye. Votchal, and A. S. Belousov 10 Mar. 1966 12 p refs Transl. into ENGLISH from Terap. Arkh. (Moscow), v. 37, issue 11, Nov. 1965 p 96–100
(JPRS-34501; TT-66-30941) CFSTI: $1.00

A thermal radiopill and telemetric system were used to determine the temperature in various parts of the human digestive track. Healthy individuals were tested to establish a normal curve of temperatures. Curves were found for patients suffering from acute or chronic inflammatory processes (acute gastritis, acute colitis, and chronic ulcerative colitis). A temperature rise was observed in the corresponding localizations of the inflammation. It was concluded that radiotelemetric investigations of the temperature offer valuable data on the state of the gastrointestinal track, and that it may determine the presence of local foci of the inflamatory process, and that the study of vascular reactions of the digestive tract is possible. N.E.N.

N66-21821*# California Univ., Los Angeles. Dept. of Anatomy.

REGIONAL CEREBRAL IMPEDANCE CHANGES IN ALERTING, ORIENTING AND DISCRIMINATIVE RESPONSES; THE ROLE OF NEURONAL ELEMENTS IN THESE PHENOMENA

W. R. Adey, R. T. Kado, J. T. Mc Ilwain, and D. O. Walter [1966] 35 p refs
(Grant NsG-505; NIH MH-03708; Contract AF 49(638)-1387)
(NASA-CR-71549) CFSTI: HC $2.00/MF $0.50 CSCL 05J

Electrical impedance was measured in the hippocampus, amygdala, and midbrain reticular formation during alerting, orienting, and discriminative performances in the cat. Measurements were made in focal volumes of approximately 1.0 cmm at 1000 cycles per second with coaxial electrodes. In the fully trained animal, computed averages of hippocampal impedance decreased by as much as 8 per cent of baseline during visual discrimination, whereas alerting and orienting responses immediately preceding were not accompanied by comparable impedance changes. Similar measurements in the rostral midbrain reticular formation showed small responses during orientation and discrimination, and less constantly during alerting responses. The amygdala exhibited consistent responses only in the alerting epoch. The magnitude of the responses in hippocampus and midbrain increased with the level of behavioral performance. Whe behavioral cues were reversed, the hippocampal impedance response sharply increased on the first post-reversal day, but rapidly declined thereafter and disappeared. Author

N66-21828# Pisa Univ. (Italy). Inst. of Physiology.

COMPARATIVE NEUROPHYSIOLOGY OF VISION Technical (Final) Report, Sep. 15, 1964–Sep. 14, 1965

Giuseppe Moruzzi 15 Sep. 1965 10 p refs
(Grant AF-EOAR-64-37)
(AFOSR-65-2011; AD-627634) CFSTI: HC $1.00/MF $0.50

The results of the following themes of investigation are reported: (1) Visual control of flashing in fireflies. (2) Presynaptic inhibition in cat's lateral geniculate body. (3) Influence of sleep and wakefulness on the response of lateral geniculate units to sinewave photic stimulation. (4) Effects of synchronized sleep on the response of lateral geniculate units to flashes of light. Author (TAB)

N66-21883# Texas A&M Univ., College Station.

BILATERAL REPRESENTATION OF THE HORIZONTAL SEMICIRCULAR CANALS IN THE INFERIOR VESTIBULAR NUCLEUS OF CATS

John Thomas Le Croix (M.S. Thesis) Aug. 1965 42 p refs
(AD-624663) CFSTI: HC $2.00/MF $0.50

The existence of bilateral representation was demonstrated in single units in the inferior vestibular nucleus of decerebrate, decerebellate cats by recording the spike potentials with tungsten microelectrodes. Recording electrodes one to two microns in diameter were stereotaxically placed in the inferior vestibular nucleus. Recordings were made from locations where the frequency of action potentials was affected by the direction of acceleratory stimulation of the horizontal semicircular canals. The ipsilateral and contralateral eighth cranial nerves were

stimulated individually by one second galvanic pulses. The individual spike potentials were amplified and recorded on moving film from the screen of a cathode ray oscilloscope. Response to electrical stimulation was demonstrated by changes in the impulse rate at the recording site. Responses were elicited by stimulation of the nerves of both sides in almost all observations. The effect of stimulation of the contralateral side was, however, usually lesser in degree than the effect in the ipsilateral side. Other effects of stimulation were also noted. The possibility that responses were due to current spread from the site of stimulation was eliminated by demonstrating the lack of response in the sectioned nerve. Electrode placements were determined histologically. Author (TAB)

N66-21959# Max-Planck-Institut fur Biophysik, Frankfurt am Main (West Germany).
RADIATION EFFECTS ON LIVING TISSUES AND ORGANISMS. SERIES C: BIBLIOGRAPHIES, SECTION 4, NUMBER 21
W. Stahlhofen comp. Apr. 1965 92 p refs
(AED-C-04-21)

Approximately 330 references are given to reports and journals published during 1964. Separate author and subject indexes are included. NSA

N66-21982# Utah Univ., Salt Lake City. Radiobiology Div.
RESEARCH IN RADIOBIOLOGY Annual Report of Work in Progress on the Chronic Toxicity Program
Thomas F. Dougherty et al 31 Mar. 1965 222 p refs
(Contract AT(11-1)-119)
(COO-119-232) CFSTI: HC $6.00/MF $1.25

Reports are presented on various research studies conducted to determine radiobiological effects in animals. Areas covered include the use of therapy and prophylactic treatment in experimental animals; dental eruption patterns in beagles; studies of trabecular bone in beagles and humans; bioassay of cortisol influence in bones of growing rabbits; cortisol effect on $Na_3CaDTPA$ enhanced excretion of Pu^{239} in beagles; EDTA effect on Sr^{90} and Y^{90} excretion; Th^{228} induced fractures in beagles; correlation of bone strength with radiation dose from internal emitters and bone resorption; and statistical methods for analyzing the hematological data from Sr^{90} injected beagles. Injection tables are also presented, showing the radioisotope dosage administered to the dogs, and cause of death. M.G.J.

N66-21976# California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
A FORTRAN IV PROGRAM FOR THE EVALUATION OF POST-IRRADIATION SURVIVAL TIMES
James L. Leitch and Nancy J. Hagen Nov. 1965 39 p refs
(Contract AT(04-1)-GEN-12)
(UCLA-12-573) CFSTI: HC $2.00/MF $0.50

A Fortran IV computer program was developed for the rapid evaluation of post-irradiation survival times in animals. It takes into account the cage effect between cages within the same experiment, a factor not covered by the Litchfield time-percent effect method of analysis. The program may also be modified for evaluating drug and toxicity studies and for extended (life span) studies on both experimental (treated) and normal (untreated) animals. The terms protection ratio and protection value are defined. A new standardization procedure to allow comparison of results from different experiments is outlined and designated survival ratio. Four appendices give the list of the program, flow diagrams for the program and the sub-program, preparation of the data deck, and an output from a single experiment. Author (NSA)

N66-21982# Notre Dame Univ., Ind. Dept. of Biology.
[RADIOBIOLOGY STUDIES] Progress Report, 1964–1965
Raphael Wilson, Mary Breudan Pierson, M. Dominique Crump, and Harold E. Esch 1965 158 p refs
(Contract AT(11-1)-205)
(COO-205-55) CFSTI: HC $5.00/MF $1.00

Gamma irradiation of rat and frog muscle preparations under mechanical stimulation produced alternations in contraction tension, contraction rate, and relaxation rate as a function of gamma dose. Release of acetylcholine from the presynaptic nerve endings or the permeability of the muscle end plates were responsible for the observed tonus changes. The electric potential of frog muscle membranes was also altered by alpha irradiation, even in the presence of nitrate, thiocyanate, iodide, bromide, and the radioprotective compound AET. Electrical properties of the internodal cells of *Nitella flexilis*, grown in diferent bath solutions, were changed by gamma irradiation from 1.5 k R up to 30 k R. The different reactions of cells in different bath solutions, especially in a K-free Findley solution, indicated cell membrane permeability as the possible site of radiation action in plants. G.G.

N66-22014# Washington State Univ., Pullman
A STUDY OF FACTORS THAT GOVERN RADIOSENSITIVITY OF PLANTS Research Report No. 16, 1 Nov. 1964–31 Oct. 1965
Robert A. Nilan and C. F. Konzak 1 Nov. 1965 13 p refs
(Contract AT(45-1)-353)
(RLO-353-4) CFSTI: HC $1.00/MF $0.50

Studies were made on the oxygen effect in dry (2 to 10% water content) and moist (11 to 14% water content) irradiated barley seeds and of the mutagenic action of oxygen in barley seeds of different water contents. The effects of nitric oxide and dimethyl sulfoxide on the oxygen effects were also investigated. The results suggest that in dry seeds oxygen availability is a limiting factor in reaching maximum damage, presumably induced through oxygen-radical interaction, and that possibly oxygen-radical interactions do occur even in moist seeds when oxygen is available. It was also found that oxygen may be more effective in moist seeds at a lower than a higher pH. NSA

N66-22052# Massachusetts General Hospital, Boston, John Collins Warren Labs.
AN INVESTIGATION ON THE MECHANISMS AND REGULATIONS OF NUCLEIC ACID AND PROTEIN SYNTHESIS, AND THEIR POSSIBLE RELATIONSHIP TO RADIATION DAMAGE Progress Report, 1 Sept. 1964–31 Aug. 1965
Paul C. Zamecnik and Joseph W. Gardella [1965] 45 p refs
(Contract AT(30-1)-2643)
(TID-21973) CFSTI: HC $2.00/MF $0.50

The various steps involved in the biosynthesis of proteins are reviewed and several aspects of the normal biosynthetic pathways are elucidated. Emphasis was placed on the relationship of the secondary structure of the transfer RNA molecule to its recognition by the enzyme involved in its acceptance of its specific amino acid. Two approaches were used: the alteration of specific bases in the transfer RNA molecule by, for example, ultraviolet irradiation; and the chemical alteration of the amino acid side chains of the enzyme, the aminoacyl-synthetase. In addition, to normal processes of growth were sufficently delineated to make feasible investigations on the details of the regulation of protein and nucleic acid synthesis

following infection by oncogenic viruses and during the process of liver regeneration. Data are included from studies on the secondary structure of s-RNA, using optical rotary dispersion; the effect of ultraviolet radiation on the formation of aminoacyl-s-RNA; the chemical modification of s-RNA; the effects of oncogneic viruses on protein and nucleic acid synthesis; and studies on growth regulation in whole cell systems. A list is included of 23 publications during the period covered by this report. NSA

N66-22084# California Univ., Berkeley. Lawrence Radiation Lab.

DISPERSION OF OPTICAL ROTATION AND BIREFRINGENCE OF BIOPOLYMERS. I: THEORY OF FARADAY ROTATION IN POLYMERS. II: ELECTRICAL BIREFRINGENCE OF TOBACCO MOSAIC VIRUS. III: OPTICAL ROTATION OF DINUCLEOSIDE PHOSPHATES

C. Allen Bush (Ph.D. Thesis) Jul. 1965 210 p refs
(Contract W-7405-ENG-48)
(UCRL-16278) CFSTI: HC $6.00/MF $1.25

The optical properties of biological polymers in the ultraviolet and the interpretation of results to give information on the structure of biopolymers in solution are discussed. The theory of Faraday effect in organic molecules is developed and Faraday rotational strengths are defined. An exciton theory of the interaction of groups in a polymer is applied to Faraday rotation. This theory is used to predict how the Faraday effect changes with polymer conformation. Experiments on the optical properties of tobacco mosaic virus (TMV) and TMV protein are described. The optical rotatory dispersion (ORD) of TMV, of TMV protein subunits, and of TMV protein in aggregated rods is reported and discussed in terms of absorbing groups. The electrical birefringence of TMV and TMV protein rods is determined as a function of wavelength of light in an attempt to determine the orientation of the absorbing groups. A calculation is included of the ORD of dinucleoside phosphates from an exciton model. The method assumes that the circular dichroism has the same dependence on wavelength as does the absorption. The ORD is obtained from a Kronig–Kramers transformation of the circular dichroism. The results of the Faraday rotation theory are applied to the effect observed in ketones. The interpretation leads to the conclusion that the 280 mμ absorption is composed of two distinct electronic transitions. In polymers, the theory predicts a structure-dependent Faraday effect. The ORD of TMV and its protein is interpreted as implying that the rods of aggregated protein resemble the native virus. The interpretation of the birefringence of TMV and the aggregated protein as a function of wavelength proved to be ambiguous. This ambiguity results partly from the small amount of RNA in the virus and partly from difficulties in separating the intrinsic birefringence from the form birefringence. The calculation of the ORD of dinucleoside phosphates gives reasonably good agreement with experiment, indicating that the exciton interaction is the origin of the large Cotton effects observed in some dinucleosides. It was also concluded that ApA and UpU are right handed helices and that, by implication, poly A at pH 7 also forms a right handed helix. The calculations suggest very strongly that all dinucleoside phosphates of the four RNA bases (A, U, G, and C) are right handed in conformation, and that they have helical increment angles of 28 to 40°. The calculation also predicts that certain dinucleoside phosphates may have very large rotations at low temperature. Author (NSA)

N66-22110# Columbia Univ., New York. Dept. of Physics.

SEMINAR ON TOPICS IN BIOPHYSICS Final Report

Roderick K. Clayton et al (C. F. Kettering Res. Lab.) [1964] 37 p refs Seminar held 29 Jun.–17 Jul. 1964
(Contract AT(30-1)-3424)
(NYO-3424-1) CFSTI: HC $2.00/MF $0.50

A program of informal lectures, discussions, and demonstrations was presented. Topics discussed included: the biochemical and physical aspects of photosynthesis; a conceptual system of molecular genetics with emphasis on the role of nucleic acids in the snythesis of enzymes from nucleic acids; the photochemistry and photobiology of nucleic acids in microorganisms; the properties, structure, and function of bacterial, plant, and animal viruses; the storage, replication, and transfer of genetic information in macromolecules with emphasis on the role of DNA and RNA in protein synthesis; physical mechanisms related to excitable cell membranes; physical aspects of biological movements, with emphasis on muscle physiology; physical studies of nucleic acids in solutions; nonchromosomal heredity, with emphasis on studies of the properties of nonchromosomal genes and mutations of a nonchromosomal genetic system in a single-celled algae, chlomydomonas; and the structures of nucleic acids, their physical properties, how the structures may be determined by physical methods, and the relation of physical properties to biological properties. NSA

N66-22171*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SOME OBSERVATIONS ON SECONDARY ASCENDING AFFERENT SYSTEMS IN THE CENTRAL NERVOUS SYSTEM

William R. Mehler [1964] 38 p refs Submitted for Publication
(NASA-TM-X-56069) CFSTI: HC $2.00/MF $0.50 CSCL 06P

Recent experimental data related to the classical notion that the principal ventral posterior lateral and medial thalamic nuclei represent significant neural relays in the central pain pathway are discussed. Emphasis was placed on the phylogenetic constancy of the terminal patterns of ascending spinal projections found in mammals ranging from the marsupial to man. Experimental data on the course and distribution of afferent projections to the mesensephalon, the distribution of somesthetic afferent fibers in the posterior thalamus, and the intralaminar afferents and connections of the nucleus centrum medianum were considered. It was concluded that experimental data argues against the hypothesis that the nucleus centrum medianum, or the central lateral, para-, and intralaminar nuclei represent the neural relays. It was further concluded that central pain pathway mechanisms might be represented by neural structures lying in the posterior thalamus or in the region of the meso-diencephalic transition. N.E.N.

N66-22173*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PRIMORDIAL ORGANIC CHEMISTRY AND THE ORIGIN OF LIFE

Cyril Ponnamperuma [1964] 15 p refs Presented at the 3d Intern. Symp. on Bioastronautics and the Exploration of Space, San Antonio, 16–18 Nov. 1964
(NASA-TM-X-54951) CFSTI: HC $1.00/MF $0.50 CSCL 06A

The synthesis of the constituents of the nucleic acid molecule and the protein molecule is reviewed. The primitive earth conditions were simulated, with respect to atmospheric composition and energies available for organic compound synthesis. Experiments are described exposing methane, ammonia, and water to ultraviolet ionizing radiation, electric discharges, and heat. Hydrogen cyanide and formaldehyde

were found as products. When these two products were further exposed to ultraviolet radiation, a wide variety of organic compounds were formed—adenine, guanine, urea, ribose, deoxyribose, and nucleoside deoxyadenosine. Dipeptides were formed by exposing an aqueous solution of glycine and leucine to uv radiation. It was concluded that molecules of biological significance can be synthesized. The results were considered to support the hypothesis of chemical evolution. N.E.N.

N66-22178# Bryn Mawr Coll., Pa. Dept. of Biology.
THE EFFECT OF ENVIRONMENTAL TEMPERATURE ON LETHALITY OF ENDOTOXIN AND ITS EFFECT ON BODY TEMPERATURE IN MICE Final Report
L. Joe Berry Jul. 1965 33 p refs
(Contract AF 41(609)-1764)
(AD-619535) CFSTI: HC $2.00/MF $0.50

Acute exposure of mice to an environmental temperature of either 5°C or 37°C reduced the LD_{50} of a crude Serratia marcescens endotoxin from a high of 2300 micrograms in mice housed at 30°C to an amount less than 40 micrograms. At 15°C or 32°C, the LD_{50} was, respectively, 880 micrograms and 550 micrograms, while at 25°C it was 1200 micrograms. Control animals placed at each of these temperatures were able to maintain normothermia except for those at the high and low extremes where they became slightly hyperthermic and hypothermic. Following an injection of either twice the LD_{50} or a dose of 1000 micrograms, the thermo-regulatory ability was upset at all temperatures except 30°C. Mice at temperatures below 30°C became progressively more hypothermic as the environment was increasingly cold and vice versa at higher temperatures. It is believed that endotoxin sensitizes mice to heat and cold rather than these temperatures sensitizing to endotoxin. After one week of acclimatization at 5°C or 37°C, the LD_{50} of endotoxin increased, respectively, to 790 micrograms and 260 micrograms. Inducibility of the liver enzyme tryptophan pyrrolase, believed to play a role in an animal's response to endotoxin, was evaluated at each environmental temperature. Only at the extremes was it suppressed. Author (TAB)

N66-22194*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FACTORS AFFECTING FATTY ACID SYNTHESIS IN CELL-FREE PREPARATIONS FROM *SACCHAROMYCES CEREVISIAE*
David White and Harold P. Klein [1964] 11 p refs Submitted for Publication
(NASA-TM-X-56530) CFSTI: HC $1.00/MF $0.50 CSCL 06M

Experiments were conducted to determine whether yeast preparations are subject to controlling influences by certain intermediates of the oxidative and fermentative metabolism of glucose. Long-chain fatty acid synthesis was demonstrated in high speed supernauts from yeast. Citrate, glucose-6-phosphate, fructose-1,6-diphosphate, and L-α-glycerophosphate were found to stimulate fatty acid synthesis. The site of stimulation appeared to be the carboxylation of acetyl-CoA. It is reported that palmityl-CoA inhibited both fatty acid and nonsaponifiable lipid synthesis, however, L-α-glycerophosphate failed to reverse the inhibition, suggesting that glycerophosphate stimulation of fatty acid synthesis is not a merely a reversal of acyl-CoA inhibition. The experimental processes are discussed and the data obtained are given. H.S.W.

N66-22216*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EARLY EFFECTS OF CORTICOSTERONE ON AMINO ACID INCORPORATION BY RAT LIVER SYSTEMS SUBSEQUENT TO ITS *IN VIVO* INJECTION
Henry A. Leon [1965] 18 p refs Submitted for Publication
(NASA-TM-X-56676) CFSTI: HC $1.00/MF $0.50 CSCL 06C

Fasted male rats were given single intraperitoneal injections of corticosterone or of saline. Amino acid incorporation into liver microsomal and cell-sap protein was subsequently assayed using cell-free systems. Endogenous pyruvate kinase and added phospho-enol pyruvate were used to maintain nucleotide triphosphate levels necessary for prolonged incorporation. Doses of 25 or 50 μg/Kg were effective in stimulating incorporation. The latter dose significantly stimulated microsomal incorporation 20% at 15 min and 118% at 30 min. Stimulation with a wider range of doses was also seen in adreno-demedullated rats, thus largely excluding epinephrine as a factor. When intact rats were injected with stimulatory doses and subsequently tested in an incorporation system utilizing added creatine kinase and creatine phosphate for energy regeneration, no consistent stimulation of incorporation at 15 or 30 min was observable. The results suggest a rapid effect of corticosterone on endogenous liver pyruvate kinase activity. Author

N66-22246# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF HYPOHYDRATION ON WORK PERFORMANCE AND TOLERANCE TO $+G_Z$ ACCELERATION IN MAN
J. E. Greenleaf, M. Matter, Jr., J. S. Bosco (San Jose State Coll.), L. G. Douglas, and E. G. Averkin [1965] 26 p refs Presented at the Aerospace Med. Conv., New York, 26–29 Apr. 1965
(NASA-TM-X-56368) CFSTI: HC $2.00/MF $0.50 CSCL 06S

Nine men were water depleted up to 6.9% of their body weight during controlled 5-day dietary periods and then subjected to various physical performance tests, including grayout tolerance while undergoing $+G_Z$-3.0 G/min. acceleration, to define set points (the % hypohydration where functional deterioration begins). Hypohydration refers to the primary water-loss type of dehydration. The following set points were observed: total body reaction time—0 to 1%; isometric muscular strength—greater than 4%; Harvard step test—4 to 4.5%; submaximal O_2 intake—greater than 4%; and $+G_Z$-3.0 G/min. centrifugation—greater than 4%. The concept of free circulating water was suggested as a possible explanation for the diversity of results regarding the effects of water depletion on bodily deterioration and work performance. Author

N66-22247*# California Univ., Berkeley. Space Sciences Lab.
SPACE PHYSIOLOGY Final Report
12 Nov. 1964 28 p refs *Its* Ser. No. 5, Issue No. 67
(Contract NAS2-1357; Grant NsG-139-61)
(NASA-CR-59790) CFSTI: HC $2.00/MF $0.50 CSCL 06S

Instrumentation for sensing and telemetering physiological information from unrestrained animals has been developed. Parameters which were monitored include blood pressure, temperature, acceleration, respiration, and the electrical signals associated with heart beat and brain activity. Sensor-transmitter units were chronically implanted in rabbits, dogs, and monkeys. Implantation methods and implant effects on animals were studied. Initial work was done on a blood oxygen

tension transducer to be implanted in a vessel or in the heart. Emphasis has been on blood pressure measurements through the intact artery wall. Studies on rabbits and dogs indicate that an artery will tolerate application of a transducer and its holder. Problems of drift, moisture penetration, and temperature sensitivity are being eliminated and pressure sensitivity is being increased. A modified blood pressure transducer-transmitter was used as a respiration monitor. In electrocardiogram and electrocorticogram units, electric signals are picked up, amplified, and used to modulate a transmitter. They can transmit continually for two years. A temperature transducer was also designed to transmit for two years. R.N.A.

N66-22248*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

QUANTITATIVE MEASUREMENT BY TELEMETRY OF OVULATION AND OVIPOSITION IN THE FOWL

C. M. Winget, E. G. Averkin, and T. B. Fryer 10 Nov. 1964 27 p refs

(NASA-TM-X-54841) CFSTI: HC $2.00/MF $0.50 CSCL 06C

A radio telemetry system was used to establish a body temperature cycle in the domestic fowl. Certain sex differences were noted. In the female, the maximum body temperature was reached at time of oviposition. The female has a 28-hr cycle and the male a 24-hr cycle. The data were evaluated by autocovariance, power spectral analysis, harmonic regression, and other methods. Author

N66-22265*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EFFECTS OF ADRENALIN OR INSULIN ON THE PERFORMANCE OF WORKING AND RESTING SUBJECTS

Clayton R. Coler, William A. Mc Laurin, and Donald R. Young [1965] 22 p refs Presented at the Aerospace Med. Conv., New York, 26–29 Apr. 1965

(NASA-TM-X-56371) CFSTI: HC $1.00/MF $0.50 CSCL 06S

The performance and physiological effects of adrenalin or insulin were studied in human subjects. After approximately eight hours of enforced work or rest, one group of nine subjects received insulin, and another group of nine subjects received adrenalin. The subjects in each drug group participated in both a working condition and a resting condition on separate occasions. Short-term memory, choice reaction time and steadiness tests were used to evaluate subject performance. Ten preinjection and seven post-injection sessions of performance testing were given. Postinjection performance decrements occurred on all three tests for all subjects, both working and resting, in the insulin group. Fewer decrements occurred in the adrenalin group. For the insulin group, postinjection decrements were most frequent in the working condition. However, for the adrenalin group, postinjection decrements were most frequent in the resting condition. Performance in the working condition of the insulin group had not recovered to preinjection levels three hours after injection, while recovery had occurred in all other conditions. Author

N66-22279*# Melpar, Inc., Falls Church, Va.

RESEARCH AND DEVELOPMENT OF AN INSTRUMENT FOR DETECTION OF EXTRATERRESTRIAL LIFE BY OPTICAL ROTATORY DISPERSION Final Technical Report

Washington, NASA, Apr. 1966 99 p refs

(Contract NASw-842)

(NASA-CR-423) CFSTI: HC $1.45/MF $0.75 CSCL 06B

A novel single-beam polarimeter capable of development to meet the requirements of a space mission to seek optical activity in extraterrestrial soil samples is described. Optical rotatory dispersion curves of extracts of soil and ancient strata were obtained with this instrument. The polarimeter is relatively insensitive to scattering, dichroism and absorption. It can make measurements of optical rotation in the presence of optical densities of approximately 5, provided the light source has sufficient spectral purity. It is concluded that the feasibility of producing an experiment to seek for optical activity in an extraterrestrial soil sample has been demonstrated. Author

N66-22280*# National Aeronautics and Space Administration. Washington, D. C.

ON THE CHANGES IN THE CHLORIDE LEVELS IN THE BLOOD, URINE, AND SWEAT ASSOCIATED WITH MUSCULAR ACTIVITY [UBER DIE SCHWANKUNGEN DES CHLORIDGEHALTES IM BLUT, HARN UND SCHWEISS BEI MUSKELTATIGKEIT]

A. F. Koriakina, E. B. Kossowskaja, and A. W. Krestownikoff Jan. 1966 24 p refs Transl. into ENGLISH from Arbeitsphysiologie (Berlin), v. 2, 1930 p 461–473 Presented at 127th Meeting of the Russian Physiol. Soc., 31 Oct. 1929

(NASA-TT-F-9736) CFSTI: HC $1.00/MF $0.50 CSCL 06S

Studies were conducted on the chloride levels in the blood, urine and sweat of individuals after various degrees and types of muscular activity. Two levels of blood chloride were discernible: it rose shortly before the start or after the cessation of a short period of work, and dropped after a longer period of exertion. The urine chloride level generally dropped, however the amount of chloride in the urine usually increases at the start of the activity. The magnitude of the drop in blood and urine chlorides stands in a direct relation to the intensity and duration of exertion. Muscular activity as a rule caused the sweat chlorides to rise. When the blood chloride level was low, no chlorides were eliminated via sweat. Finally, chloride metabolism during muscular activity was related to the general water and salt metabolism. One thing that does appear certain is that the release of chlorides through perspiration requires a certain blood chloride level, and this minimum level varies greatly. Author

N66-22360*# California Univ., Berkeley.

CHRONIC ACCELERATION STUDIES: PHYSIOLOGICAL RESPONSES TO ARTIFICIAL ALTERATIONS IN WEIGHT Final Technical Report, 1962–1965

C. F. Kelly and A. H. Smith Washington, NASA, Apr. 1966 10 p refs Prepared for ONR

(NASA Order R-53)

(NASA-CR-441) CFSTI: HC $0.10/MF $0.50 CSCL 06S

Centrifuge tests were conducted in order to determine the pathological and physiological responses of an organism to chronic acceleration, i.e., prolonged exposure to force fields greater than the gravity of the earth. Chickens were gradually introduced to a force of 3G and were kept at this level for periods up to several months. The following results are reported. The exposure of animals to chronic acceleration may result in a substantial mortality rate up to 30% for three months. Survival in hyperdynamic environments requires physiological adaptation. Physiological adaptation to hyperdynamic environments may be retained for long periods of time. The factors which permit animals to tolerate hyperdynamic environments are heritable. Based on these and other results, it is concluded that: (1) organisms can physiologically adapt themselves to chronic acceleration, up to some limiting intensity which is inversely related to body size; and (2) the

physiological and anatomical changes appear to be proportional to the accelerative force. D.T.

N66-22377*# Schwarz BioResearch, Inc., Orangeburg, N. Y.
SUPERIOR DIET FOR MAN IN SPACE Annual Report, Oct. 1964–Oct. 1965
Norman A. Rosenthal Apr. 1966 220 p refs
(Contract NASw-517)
(NASA-CR-71817) CFSTI: HC $6.00/MF $1.25 CSCL 06H

Experiments using rats were conducted to study the stability of liquid diet solutions. The phenomenon of browning was considered and it was determined that a loss of biological activity and the development of a toxic character in the diet solution are accompanied by the appearance of browning. Studies further revealed that this phenomenon can be arrested and a mechanism for this reaction is given. Rats were given diet solutions that were exposed to radiation and, at high radiation levels, only a slight loss in biological activity was observed; however, a marked loss in biological activity occurs when the solutions are stored at room of higher temperatures. Liquid chemical diets were prepared using acid protein hydrolysates and were reported to be comparable to diets prepared from pure individual amino acids. It was determined that a 30% weight volume ratio liquid diet solution is sufficient to satisfy the nutritive requirements of a growing rat. A method, using deuterium oxide, was also discussed for determining the interrelationships of dietary water to drinking water. H.S.W.

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N66-21110# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
EFFECTS OF VISUAL FIXATION AND UNCERTAINTY ON CONTROL PANEL LAYOUT Final Report, May 1963–Dec. 1964
Donald A. Topmiller and Earl D. Sharp Oct. 1965 37 p refs
(AMRL-TR-65-149; AD-627702) CFSTI: HC $2.00/MF $0.50

Seated subjects reached to and operated 12 toggle switch controls located 31, 41, and 51 inches above the floor and 0, 25, 50, and 75 degrees to the left of the mid-sagittal plane. The effects on the reaction time, reach time, and total response time of three-variables–control location, visual fixation/uncertainty, and anthropometric size of subjects–were investigated. Analyses of variance indicate that control location and visual fixation/uncertainty affect reaction, reach, and total response time; but body size does not. Derived scores were also analyzed to permit detailed examination of the perceptual-motor components of the response scores. The linear relationships between reach rate and reach distance observed in this study are compared with the curvilinear relationships reported in micromotion literature. To aid in evaluating control arrangements, response-time isograms are presented. Author (TAB)

N66-21119# North American Aviation, Inc., Columbus, Ohio.
EFFECTS OF DISPLAY QUICKENING ON HUMAN TRANSFER FUNCTIONS DURING A DUAL-AXIS COMPENSATORY TRACKING TASK Final Report, May 1963–Jun. 1964
Angelo P. Verdi, George N. Ornstein, Richard P. Heydorn, and George Frost (AMRL) Wright-Patterson AFB, Ohio, AMRL, Nov. 1965 220 p refs
(Contract AF 33(657)-11102)
(AMRL-TR-65-174; AD-627671) CFSTI: HC $6.00/MF $1.25

The research was concerned with the human's behavior in adapting his response mode to variations of certain conditions of a compensatory tracking task. The task conditions evaluated were quickening level, system gain, task load, and task complexity. The results of the studies show good agreement with the transfer function 'adjustment rules' developed by other investigators. When quickening is introduced, the human adjusts his transfer function in a systematic and predictable manner in response to variations of the quickening level. As the amount of quickening increases the operator increases gain and lag but decreases lead. The human adjusts his equalizing parameters to achieve stable loop performance for all quickening levels. Man's ability to reduce the system error is significantly affected by the distribution of gains in the overall man-machine system. The human's transfer function for single and dual task load conditions probably differs. Tracking error was found to be least when the quickening level used in the second axis is identical to that in the axis of primary interest; error increased as the quickening levels for the two axes became more dissimilar. Author

N66-21132# Normalair, Ltd., Yeovil (England).
THE DESIGN OF A PERSONAL PORTABLE CONDITIONING SET FOR MOON BASED OPERATIONS
P. W. Fitt and B. Corrigan [1965] 21 p
CFSTI: HC $1.00/MF $0.50

Human engineering was approached from the direction of providing moon explorers with pressure suits which afford comfortable environments. The study covered pressurization, heat dissipation, personal cooling, and ventilation and breathing. It was decided that the pressure suits be provided with totally self contained conditioning equipment independent of any umbilical attachments. A description was given of the conditioning circuit believed to be capable of meeting the full requirements for moon based operations. This set would have a total weight of about 56 lb. in earth units and its weight would be located close to the user's back to avoid excessive inertial effects when turning. C.L.W.

N66-21168# Naval Air Development Center, Johnsville, Pa. Aerospace Medical Research Dept.
CINERADIOGRAPHIC OBSERVATIONS OF HUMAN SUBJECTS DURING TRANSVERSE ACCELERATIONS OF $+5G_x$ AND $+10G_x$
Harold Sandler 21 Oct. 1965 17 p refs
(NADC-MR-6501; AD-625254) CFSTI: HC $1.00/MF $0.50

X-ray motion pictures were recorded for five human subjects during transverse accelerations of $+5G_x$ and $+10G_x$ on the Johnsville centrifuge. Quantitative measurements of change in A-P chest diameter and heart position were made from photographic prints of the films. A slight but significant posterior displacement of heart position could be demonstrated when compared to change in the A-P chest diameter. Author (TAB)

N66-21184# Joint Publications Research Service, Washington, D. C.

COORDINATION OF HUMAN VOLUNTARY MOVEMENTS DURING FLIGHT IN OUTER SPACE

Levan Vladimirovich Chkhaidze 22 Mar. 1966 140 p refs Transl. into ENGLISH of the book "Koordinatsiya Proizvol'nykh Dvizheniy Cheloveka V Usloviyakh Kosmicheskogo Poleta" Moscow, "Nauka", 1965 p 1-111

(JPRS-34654; TT-66-31093) CFSTI: $4.00

The problem of man's motor coordination in a modified gravity field, as a consequence of spatial exploration, is discussed. In approaching the problem, the most important material on the general principles of voluntary movement coordination of human beings and animals on the whole was systematized. This material is given as the basic biophysical mechanisms involved, and tasks confronting the central nervous system during the regulation of voluntary movements. An increase in the gravitational field was simulated by inertial forces appearing during accelerations. It was found that an increase in the gravitational field not only led to disturbance of the assigned motor coordination, but also influenced the dynamic component of motion which was the basis of the manual pressure tests studied. However, due to the properties of the central nervous system, reinforced by training, coordination of voluntary movements will return to the familiar norm. Under conditions of decreased and zero gravity in parabolic aircraft flight and in orbital flight, it was determined that serious disorders of coordination of voluntary movements should not be expected after sufficient training and that stable performance quickly replaces any initial motor impairment. E.A.O.

N66-21194# Naval Air Development Center, Johnsville, Pa. Aviation Medical Acceleration Lab.

METHODOLOGICAL PROBLEMS OF THE PSYCHOPHYSICAL METHODS OF LIMITS AND CONSTANT STIMULI

Robert M. Herrick 30 Jun. 1965 41 p refs

(NADC-ML-6505; AD-624452) CFSTI: HC $2.00/MF $0.50

The method of limits (ML) and the method of constant stimuli (MCS) can be related on the basis of simple probability considerations. From the probability relationship many deductions may be made. Examples of such deductions indicate, among other things, (a) the characteristics of distributions of thesholds in the ML, (b) the influence of the number of stimulus steps, the number of 'Yes' responses required at a step, the number of threshold determinations, etc., (c) preferred methods for comparisons within the ML and between the ML and the MCS, (d) incompatibility of present-day assumptions concerning the ML and the MCS.

Author (TAB)

N66-21216# Joint Publications Research Service, Washington, D. C.

SPACE PENETRATION AND MAN'S IMPRESSION OF OUTER SPACE

A. A. Leonov and V. I. Lebedev 18 Mar. 1966 15 p Transl. into ENGLISH from Vopr. Filosofii (Moscow), no. 1, 1966 p 3-11

(JPRS-34615; TT-66-31054) CFSTI: $1.00

Presented is the translation of an article by Soviet cosmonaut A. A. Leonov and candidate of Medical Sciences V. I. Lebedev. In this article the authors touch upon many problems encountered in perceiving spatial relationships by a man during cosmic flight. The article was written for the purpose of drawing the attention of philosophers and psychologists to these problems. M.R.W.

N66-21217# Joint Publications Research Service, Washington, D. C.

A HUMAN EMBARKED INTO OUTER SPACE

N. M. Sisakyan et al 15 Mar. 1966 28 p Transl. into ENGLISH from Chelovek Vyshel V Kosmich. [illegible]anstvo (Moscow), 1966 p 3-10

(JPRS-34576; TT-66-31016) CFSTI: $2.00

Brief discussions on Soviet scientific and technical achievements in the field of space research are presented. The following topics are considered: first attempts at the entry of man into free space (i.e., "walk-in-space"); training of the astronauts; problems of space psychophysiology; the success, accomplishments, and descriptions of Russian space flights, elaborated by astronauts Belyaev and Alekseyev. M.R.W.

N66-21219# United Kingdom Atomic Energy Authority, Harwell (England). Health Physics and Medical Div.

FILM DOSIMETRY PRACTICE WITH THE A.E.R.E./R.P.S. FILM HOLDER: A COLLECTION OF EXPERIMENTAL DATA

N. Adams, M. J. Heard, and P. D. Holt 1965 90 p refs

(AERE-R-4669) HMSO: 12s

Because various laboratories of the U.K. Atomic Energy Authority and the Radiological Protection Service had adopted the same film dosemeter for personnel monitoring (viz. Kodak R.M. film contained in the AERE/RPS plastics holder) it was desirable to establish agreed film dosimetry procedures. These procedures are supported by experimental measurements, made over several years by various workers and now collected together in this report for the benefit of users of this film dosemeter and of other dosimetry workers. The experimental programmes included investigations of the following: (1) response of the film dosemeter to photon and beta radiation; (2) photographic processing, dose-density relation, developer performance; (3) calibration, design of calibration jig, choice and use of radioactive source and calibration films; and (4) dose assessment, comparison of AERE and RPS systems.

Author

N66-21240*# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.

ANALYSIS OF PREDICTOR MODEL

J. Kreifeldt 6 Jul. 1964 41 p

(Grant NsG-107)

(NASA-CR-62006; M-9991-2) CFSTI: HC $2.00/MF $0.50 CSCL 05H

In this outline a model of a human operator controlling a vehicle was analyzed. The model attempts to account for the fact that in many situations (i.e., driving) the operator has an input which is not a single point in time but an input which has spatial as well as time features. That is, he can look at the road ahead. The sampling theorem in spatial coordinates was invoked in order to treat the time-space input as k discrete inputs to the operator simultaneously available. The model then states that the operator runs some sort of thought experiment in which he extrapolates his position and computes future error if he maintains the same control signal. This computed and weighted predicted error forms the basis for his control action. His thought experiment requires π seconds and during this time the control signal remains constant. The model performs the thought experiment by computing from vehicle initial conditions and command signal, what the errors will be at the previewed points. These individual errors are simultaneously computed and weighted in a length of time requiring π seconds. The transformed impulse response for this model was derived and seen to be composed of discrete and continuous elements. This impulse

response was specifically evaluated for a first-order vehicle and two input points. It was seen that if stable, it eventually reaches a reference step height input. Author

N66-21369# Dunlap and Associates, Inc., Washington, D. C.
HANDBOOK FOR THE CONSIDERATION OF TRAINING FUNCTIONS DURING DESIGN OF OPERATIONAL EQUIPMENT
R. Gebhard, J. M. Gradijan, and F. A. Brooks, Jr. Port Washington, N. Y., Naval Training Device Center, 8 Jul. 1965 82 p
(Contract N61339-1450)
(NAVTRADEVCEN-1450-2; AD-625828) CFSTI: HC $3.00/MF $0.75

The handbook was prepared on a one-year study of how training considerations should be made during operational system design. For many systems, categories of operations can be defined according to whether on-system practice will normally be provided during mission fulfillment; can be provided at some degradation to mission or equipment; can be provided if additional equipment (not essential to functioning of the basic machine) simulates the external environment; or can be provided if internal state modification possibilities have been incorporated into the basic machine. Beyond this operation categorization scheme, many factors, called training trade-offs, which must be considered in the allocation of training resources are discussed. Author (TAB)

N66-21392# Air Force Systems Command, Bedford, Mass. Decision Sciences Lab.
EFFECT OF INTENSITY CHANGES IN AUXILIARY STIMULI ON AUDITORY AND VISUAL SIGNAL DETECTION
William H. Watkins Dec. 1965 63 p
(ESD-TR-66-121; AD-628188) CFSTI: HC $3.00/MF $0.75

Results of automated tone detection experiments are reported. Subjects were required to identify one of four short intervals as having contained a weak, earphone-presented, auditory signal. These experiments involved approximately 20,000 trails. Each experiment employed at least two lighting conditions. In general, when the light source intensified during the intervals, detection was superior to that occurring when the light diminished at corresponding times. The findings are compared with the results of analogous experiments involving visual signal detection under several conditions of auditory stimulation. Some possible explanations for consistencies in the two kinds of experiments are considered, and individual differences are discussed. Author (TAB)

N66-21451 Joint Publications Research Service, Washington, D. C.
ON "MAN-MACHINE" SYSTEM
Hsu-yen Tu *In its* Transl. on Communist China's Sci. and Tech. 10 Mar. 1966 p 70-78 Transl. into ENGLISH from K'o Hsueh T'ung Pao (Peking), no. 12, Dec. 1965 p 1043-1049 (See N66-21446 11-05) CFSTI: $3.00

The human factors in the man-cycle of the man-machine system were studied in an effort to overcome man-machine maladjustment and to reach a man-machine harmony for more reliable, effective, efficient, and economic operations. Mathematical and theoretical analyses were only considered as complementary methods. Simulated systems were proposed for studying man's decision making and the development of the mechanical characteristics of the machine while the limiting conditions of man remain. Cooperation of experts in the field of biology, psychology, medicine, automation, mechanics, electronics, etc., were advocated. G.G.

N66-21452# Sperry Rand Research Center, Sudbury, Mass.
EVALUATION OF SPEECH PROCESSING DEVICES. I: INTELLIGIBILITY, QUALITY, SPEAKER RECOGNIZABILITY Final Report, 1 Jun. 1964-31 Jul. 1965
William D. Voiers, Marion F. Cohen, and Juozas Mickunas 31 Jul. 1965 169 p refs
(Contract AF 19(628)-4195)
(SRRC-RR-65-94; AFCRL-65-826; AD-627320) CFSTI: HC $5.00/MF $1.00

Three bases of evaluation are dealt with: intelligibility, speaker recognizability and aesthetic acceptability or quality. A two-choice diagnostic rhyme test for the transmission of consonant information has been developed. It yields a total intelligibility score plus diagnostic scores relating to the fidelity with which seven binary attributes of consonant phonemes are transmitted to the ear of the listener. These attributes are voicing, nasality, duration and frication (as opposed to plosion) i.e., front (as opposed to middle) middle (as opposed to back) and back (as opposed to front). For treating the problem of speaker recognizability, procedures have been developed by means of which listeners' ratings of voices on various perceived acoustic traits can be analyzed to predict speaker recognizability under any given transmission condition. The problem of evaluating the aesthetic acceptability or quality of transmitted speech is treated by means of the standard unit-variance method. Primary emphasis is placed upon the contributions of the channel to the quality of the received speech. However, the method is adaptable for purposes of studying qualitative variation attributable to the source (i.e., the speaker). Author (TAB)

N66-21472# General Electric Co., Oklahoma City, Okla.
A MATHEMATICAL MODEL OF FLASHBLINDNESS Final Report, 1 Nov. 1964-31 Aug. 1965
Robert S. Czeh, Arthur W. Casper, and Ernest C. Segraves, Jr. Brooks AFB, Tex., School of Aerospace Med., Oct. 1965 68 p refs
(Contract AF 41(609)-2644)
(AD-627332) CFSTI: HC $3.00/MF $0.75

In planning certain military missions it is desirable to know the extent to which vision may be impaired by the flashblindness that can result from the intense light of a nuclear explosion. This report describes an attempt to provide assistance to such planning by constructing a mathematical mode of flashblindness. The literature was surveyed to determine whether or not the construction of a model was feasible. Using selected data, two equations were developed for predicting recovery time from flash energy, display luminance, and display visual acuity. The prediction errors made were determined in a few situations and compared with the errors made by other prediction techniques. Limitations of the applicability of the equations were noted. Author (TAB)

N66-21563*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TRANSONIC WIND-TUNNEL INVESTIGATION OF THE EFFECT OF CONTROL SPAN AND LARGE WING-TIP NACELLES ON EFFECTIVENESS OF SPOILER-SLOT-DEFLECTOR CONTROLS ON AN UNSWEPT-WING FIGHTER-TYPE AIRPLANE
Dewey E. Wornom Washington, NASA, May 1960 34 p refs
(NASA-TM-X-280) CFSTI: HC $2.00/MF $0.50 CSCL 01A
(Declassified)

Six-component force and moment data were obtained through an angle of attack range of about −6 to 16° in order to determine the effect of control span and large-wing-tip nacelles on spoiler-slot-deflector effectiveness. Complete control extended from 29 to 86% of the wing semispan, and was located between the 80 and 94% chord lines. The unswept wing of the fighter-type aircraft had an aspect ratio of 2.42 and a taper ratio of 0.433. At low angles of attack, the outboard two-thirds control span was nearly as effective as complete control. At high angles of attack and at Mach numbers below 0.95 all control span lost effectiveness. Wing-tip nacelles increased the rolling moment coefficient except at angles of attack above about 7° for Mach numbers 0.90 and below. Testing was in an 8-foot transonic pressure tunnel at Mach numbers between 0.60 to 1.20. M.W.R.

N66-21564*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
STUDY OF SPACECRAFT ON-BOARD TEST AND DATA PROCESSING TECHNIQUES Final Summary Report
Dec. 1965 32 p
(Contract NAS2-2479)
(NASA-CR-71611; LMSC-4-05-65-5) CFSTI: HC $2.00/MF $0.50 CSCL 06B

State-of-the-art biological instrumentation and on-board data processing for biological space missions are surveyed in order to project requirements for future missions and to postulate the necessary data system configurations. Emphasis is placed on the assessment of data loads imposed on the telemetry system by various informations sources. An analysis is presented of redundancy-reduction methods found during the survey, and advanced data compression techniques have provided three distinct levels of compression. M.W.R.

N66-21581 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SHIELDING AN ASTRONAUT AGAINST ELECTRONS AND BREMSSTRAHLUNG IN THE TERRESTRIAL RADIATION BELT
Ye. Ye. Kovalev, D. P. Osanov, G. B. Radziyevskiy, A. D. Mel'nik *In its* Cosmic Res., Vol. 3, No. 5 20 Jan. 1966 p 190–202 refs (See N66-21566 11-30) CFSTI: HC $6.00/MF $1.25

Consideration is given to the shielding of an astronaut against electrons and bremsstrahlung of the terrestrial radiation belt. There is a discussion of the methodological problems involved in the design of the shielding, and problems associated with the selection of the criteria to evaluate the radiation danger, and the features of shielding geometry. A design is presented for the shielding of an astronaut situated in the radiation belt outside of his vehicle. Experimental data on the depth distribution of electron doses in light-atom materials are used in the calculations. The possibility of using a uniform dose distribution for electrons in the energy interval up to 3 MeV is demonstrated. Estimates are also presented of the tissue doses of bremsstrahlung formed by electrons in the shielding shell. Author

N66-21624*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
HUMAN ENGINEERING DESIGN CRITERIA STUDY Final Report
S. Truax, W. R. Harmer, T. J. Wong, D. L. Van Kekerix, and L. R. Uyeda 31 Jan. 1966 446 p refs
(Contract NAS8-11256)
(NASA-CR-71532; MSFC-STD-267A) CFSTI: HC $7.45/MF $2.25 CSCL 05E

The document is a human engineering design criteria study which includes design criteria for the following areas: control, display, control-display interaction, human capabilities, human responses, anthropometry, work space, illumination, vibration, noise, temperature, clothing, safety and maintainability. Check lists, rating scales and references are provided. The document is designed to be used by design engineers and by human factors engineering personnel to assist them in their design of earth launch systems. Author

N66-21850# Goodyear Aerospace Corp., Akron, Ohio.
LIFE SUPPORT SYSTEM FOR STAY TIME EXTENSION MODULE (STEM)
F. R. Gross 20 Jan. 1965 58 p
(SP-3778)

Changes and modifications to the Life Support System for the Stay Time Extension Module are described. The number of blowers for the shelter air circulating system was reduced from three to two, which will still satisfy redundancy requirements. A major change was made in the space radiator arrangement. The two space radiators previously embedded in the shelter wall were replaced by one space radiator which is independent of the shelter wall. Facilities for removing heat from the cooling vests of the astronauts were added. Cooling water is now being circulated through the vests and a coil in the waste water evaporator. A major addition to the life support system weight is due to furnishing cooling water for the back packs of the astronauts, worn by them while exploring the moon. Carbon dioxide with molecular sieves and a dual atmosphere for the shelter, consisting of oxygen and nitrogen, was investigated. Both systems were found heavier than the original lithium hydroxide system and the single component atmosphere. These latter systems were therefore retained. Pumping the airlock down before the astronauts open the outer door was also investigated. A proposed working schedule for the astronauts is outlined. M.R.W.

N66-21899# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Hypersonic Research Lab.
PITOT AND STATIC PRESSURE MEASUREMENTS IN THE SEPARATED REGION OF SPIKED CYLINDER IN HYPERSONIC FLOW
William G. Reinecke, H. Harvey Album, and Thomas Johani Nov. 1965 61 p refs
(ARL-65-237; AD-628683) CFSTI: HC $3.00/MF $0.75

Pressure measurements were made in the region of separation induced by a sharp spike ahead of a flat faced, right circular cylinder at Mach 11.6. The pressures on the face of the cylinder were measured with both surface orifices and a traversing probe. A pitot survey was also made of the free shear layer. The results indicate that the face traversing probe did not influence the separated region greatly and gave pressure values generally in agreement with the surface orifices. The pitot probe, which was inserted farther upstream, influenced the separated region more critically, but not so much as to preclude the production of useful pitot surveys. Chapman's two-dimensional theory predicted well the maximum pressure on the model face as determined by the face traversing probe. Moreover, the tests indicated that a uniform static plateau pressure characterized the separated region. This plateau pressure was slightly Reynolds number dependent. Thus the Chapman–Korst separation and reattachment model

seems generally to cover the test configuration. A simplified analysis was made using the pitot survey of the free shear layer one body radius ahead of the model face. The results showed that the Mach number on the dividing streamline was sonic or supersonic and that the speed on the dividing streamline was from 0.4 to 0.6 of the external speed.
Author (TAB)

N66-21890# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
MANNED TESTING OF A SEMIPASSIVE POTASSIUM SUPEROXIDE ATMOSPHERE CONTROL SYSTEM Final Technical Report, Jul. 1965
Donald A. Keating, Konrad Weiswurm, Clemens M. Meyer, George W. Filson, and Irving H. Lantz Nov. 1965 12 p refs Prepared in cooperation with MSA Res. Corp.
(Contract AF 33(615)-1518)
(AMRL-TR-65-194; AD-628040) CFSTI: HC $1.00/MF $0.50

A potassium superoxide atmosphere control system using the optimum features of passive and dynamic techniques was man-tested for 24 hours. The results demonstrate the feasibility of using a potassium superoxide system of this design for manned space missions. This semipassive technique is applicable to short missions as well as longer missions. The findings indicate that significant weight, volume, and power savings can be obtained using the semipassive technique as compared to dynamic techniques used in other solid chemical atmosphere control systems. Author (TAB)

N66-21908# Aviation Safety Engineering and Research, Phoenix, Ariz.
IMPACT TEST METHODS FOR HELMETS. SUPPLEMENT 1 TO HELMET DESIGN CRITERIA FOR IMPROVED CRASH SURVIVAL
J. W. Turnbow Ft. Eustis, Va., Army Aviation Mater. Labs., Jan. 1966 24 p refs
(Contract DA-44-177-AMC-254(T))
(USAAVLABS-TR-65-44A, Suppl. 1; AD-628679) CFSTI: HC $1.00/MF $0.50

An analysis is presented on the primary methods of impact testing crash helmets and includes certain problems associated with each test method in interpreting test results. The three basic impact test methods employ impact of a movable head-helmet assembly with a movable striking mass, impact of a movable striking mass against a fixed head-helmet assembly, and impact of a movable head-helmet assembly against a fixed anvil. The evaluation and/or comparison of helmet performance is based on the measurement of head acceleration, energy absorption capacity, and resilence. The test method selected should permit these measurements to be made simply and without bias due to helmet weight and other possible variables unless the measured quantities can be readily and accurately corrected for such bias. These analyses illustrate the effect of two variables, the mass of the test components, and the coefficient of restitution upon the energy absorption and acceleration levels. R.N.A.

N66-21913# Michigan Univ., Ann Arbor. Coll. of Engineering.
TRANSMISSION OF THE HUMAN EYE Final Report, 15 Mar. 1962-14 Aug. 1965
E. A. Boettner and J. R. Wolter Brooks AFB, Tex., AF School of Aerospace Med., Jan. 1966 28 p refs
(Contract AF 33(657)-8880)
(Rept.-05096-1-F; AD-628333) CFSTI: HC $2.60/MF $0.50

The total transmittance of light through the whole human eye has been measured at 466, 566, 666, and 800 millimicrons. The forward scattering of light in passing through the eye was also measured. The results obtained on four of five specimens shortly after enucleation showed that the average maximum transmittance was 81.6% at 666 millimicrons. The forward scattered light outside of 1 degree was 35%= 5% for the five specimens at 566 and 666 millimicrons.
Author (TAB)

N66-21923# Naval School of Aviation Medicine, Pensacola, Fla. Naval Aerospace Medical Inst.
THE RELATIONSHIP OF THE EDWARDS PERSONAL PREFERENCE SCHEDULE TO SUCCESS IN NAVAL FLIGHT TRAINING
Floyd E. Peterson, Norman E. Lane, and Robert S. Kennedy 8 Oct. 1965 14 p refs
(NAMI-946; AD-627011) CFSTI: HC $1.00/MF $0.50

The Edwards Personal Preference Schedule, a forced choice personality 'need' inventory, was evaluated as a predictor of success or failure in naval flight training. The EPPS failed to discriminate between student aviators who completed training successfully and those who dropped voluntarily or failed due to poor performance. Author (TAB)

N66-22195*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
METHODS OF CONFUSION IN A PATTERN MATCHING TASK
James A. Duke [1965] 14 p refs Presented at the 45th Ann. Meeting of Western Psychological Assoc., Honolulu, Hawaii, 14-19 Jun. 1965
(NASA-TM-X-56674) CFSTI: HC $1.00/MF $0.50 CSCL 05H

Human response to various changes in patterns was examined. The methods used to induce pattern degradation are discussed and the experimental procedures that were used are explained. The differences in response choices given by male and female subjects is noted and the data obtained is tabulated. It was concluded that different types of degradation influence response choices and these choices are also influenced by the amount or level of degradation. It is reported that while the analysis failed to show consistent sex differences across all the combinations of degradations investigated, it did show that in half the cases there was an interaction between the level of degradation and the sex factor. H.S.W.

N66-22198*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MANUAL CONTROL FOR THE MORL
Ralph W. Will [1964] 21 p refs Presented at the SAE-18 Comm. Meeting, New York, 8-10 Jul. 1964
(NASA-TM-X-56445) CFSTI: HC $1.00/MF $0.50 CSCL 05H

Mission objectives and control system functions for the Manned Orbital Research Laboratory are outlined and a manual control concept for these functions is discussed. Laboratory operations console layouts and experimental program requirements are used to develop procedures for the manual control tasks. Evaluation of man's capability in controlling the laboratory motions under typical mission and emergency conditions has been made using the flight control simulator, and these data are compared with automatic system performance. The simulator results are then used to optimize the control system characteristics for the manual control mode. Author

N66-22220*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HUMAN TRANSFER FUNCTIONS FOR MULTI-AXIS AND MULTI-LOOP PROBLEMS
James J. Adams [1965] 12 p refs Presented at the AIAA 4th Manned Space Flight Meeting, St. Louis, 11–13 Oct. 1965
(NASA-TM-X-56684) CFSTI: HC $1.00/MF $0.50 CSCL 05H

Transfer function data on multi-axis pilot response are presented. The data illustrates an upper limit on response that is considered to be a limit on the pilots information processing capacity. Application of the transfer function data to a multi-loop command maneuver is also presented. The measurements were made by matching an analog model (constructed with analog computing equipment) to the pilot by automatically adjusting three gains in the model. An example of the ability of the parameter-tracking method to identify a known system; and a sample time history of the roll response of subjects in a three-axis test are graphically depicted. The curves illustrate the match that is achieved between human and model; and illustrate the time variation in the measured model gains that is typically encountered in multi-axis tests. To show the distinction between a multi-axis and multi-loop problem, block diagrams of the two types of systems are shown. In addition the time histories of a human controlled response to a 1000 ft translation command and the response obtained using the analog models for the pilot are shown. L.S.

N66-22269*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
NASA/LANGLEY 55' VACUUM CYLINDER MAN RATING Final Design Report
[1965] 316 p refs
(Contract NAS1-5311)
(NASA-CR-66076) CFSTI: HC $7.00/MF $1.75 CSCL 05E

A 55' vacuum cylinder is described for use as a man rated chamber such that men equipped with pressurized suits can be assigned to perform tasks within the chamber representative of those required for servicing and repair of spacecraft in orbit and on extraterrestrial surfaces, for exploration on these surfaces utilizing self and vehicle locomotion, and for establishment of shelters and bases needed for protection and research. The designs presented here have been performed in accordance with the requirements. The necessary services and equipment can be divided conveniently into seven major categories or systems exclusive of the repressurization and man-lock systems which are considered a part of the vacuum cylinder per se and thus not considered in design detail as part of this program. The seven systems, their respective design considerations, and procurement specifications, are discussed separately. Author

N66-22272*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HUMAN TRANSFER FUNCTIONS IN MULTI-AXIS AND MULTI-LOOP CONTROL SYSTEMS
James J. Adams, Hugh P. Bergeron, and George J. Hurt, Jr. Washington, NASA, Apr. 1966 46 p refs
(NASA-TN-D-3305) CFSTI: HC $0.65/MF $0.50 CSCL 05H

Measurements were made of the response of a human pilot in multi-axis tracking tasks. These measurements are the gains in the transfer function of the pilot and the performance measure, root-mean-square error. The measured transfer functions were used to obtain analytically the closed-loop system characteristics. The results show that the pilot changes the response so that the system frequency is reduced as additional axes requiring control are added to the work load. It is shown that these results can be correlated with a theory that the pilot has a given maximum information processing capacity. These measured multi-axis response characteristics were used to obtain a quantitative description of the characteristics of a multi-loop manually controlled guidance system. The time history of the manually controlled system can be reproduced by using two linear analog models, one for each loop, arranged in series, to represent the pilot. Measurements made in the multi-axis test can be applied to the inner loop, and the same form of the model with modified gains can be used in the outer loop. Author

N66-22284*# National Aeronautics and Space Administration, Washington, D. C.
MANEUVERING IN FREE SPACE [V BEZOPORNOM PROSTRANSTVE]
V. Stephantsov, A. Yeremin, and S. Alekperov Jan. 1966 18 p refs Transl. into ENGLISH from Aviats. i Kosmonavt (Moscow), v. 47, no. 7, 1965 p 48–53
(NASA-TT-F-9883) CFSTI: HC $1.00/MF $0.50 CSCL 05E

Consideration of methods of orienting the human body under conditions of weightlessness in the absence of a support. Various techniques for making the body rotate by moving the arms and legs are described. It is shown that the most favorable methods of rotating the body are those initiated by movements of the legs. A rotation where the legs are spread apart in a scissors-like fashion in the front-to-back direction is singled out for particular attention and is recommended as the main method to be used in orienting the body about its longitudinal axis. Author

N66-22300*# National Aeronautics and Space Administration, Washington, D. C.
VISUAL OBSERVATION OF INFRARED LASER EMISSION [O VIZUAL'NOM NABLYUDENII INFRAKRASNOGO IZLUCHENIYA OPTICHESKOGO KVANTOVOGO GENERATORA]
L. S. Vasilenko, V. P. Chebotayev, and Yu. V. Troitskiy Feb. 1966 8 p ref Transl. into ENGLISH from Zh. Eksperim. Teor. Fiz. (Moscow), v. 48, Mar. 1965 p 777–778
(NASA-TT-F-9888) CFSTI: HC $1.00/MF $0.50 CSCL 06D

Description of experiments in visual perception of intense coherent infrared radiation. Radiation of 0.95, 1.11, 1.15 and 1.18 μ from a gas laser was observed with the unaided eye. Radiation with $\lambda = 0.95\ \mu$ is perceived as red light, while radiation with $\lambda = 1.11$, 1.15 and 1.18 μ is perceived as light with half the wavelength of red light. Author

N66-22386*# National Aeronautics and Space Administration, Washington, D. C.
NASA ASTRONAUTS
[1966] 31 p
(NASA-EP-34) GPO: HC $0.20; CFSTI: MF $0.50 CSCL 05I

This illustrated brochure describes the qualifications and training of NASA astronauts. A brief biography of thirty three of the active astronauts is also included. H.S.W.

N66-22372*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
A TIME CONSTANT INVOLVED IN ATTENTION AND NEUTRAL INFORMATION PROCESSING

Alfred B. Kristofferson Washington, NASA, Apr. 1966 45 p refs
(Contract NAS2-2486)
(NASA-CR-427) CFSTI: HC $0.70/MF $0.50 CSCL 05J

Three behavioral time parameters are defined and experiments have been done which allow them to be estimated independently for single individuals. The three parameters are equal in magnitude, about 50 msec., for the group of subjects. They are highly correlated over individuals. They are independent of sensory modality. And they vary over individuals in the same way and to the same extent in relation to another variable. It is concluded that they are identical. Further, a simple theory provides an integrated interpretation of the three. In one small experiment it is shown that the behavioral cycle time is approximately equal to the interval between zero-crossings of the alpha rhythm of the electroencephalogram and that there are significant correlations over individuals between this neurophysiological quantity and the behavioral parameters.
Author

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N66-21117# Pennsylvania State Univ., University Park. Materials Research Lab.
CRYSTAL CHEMISTRY STUDIES Quarterly Report, 13 May–13 Aug. 1965
Rustum Roy, S. Kachi, G. J. Mc Carthy, O. Muller, and W. B. White 24 Aug. 1965 18 p
(Contract DA-28-043-AMC-01304(E))
(QR-1; AD-627406) CFSTI: HC $1.00/MF $0.50

Research has been concerned with (1) the systematic study of the rare earth–rhenium oxide systems in a search for new ferrimagnetic compounds. Several ternary phase areas have been determined and work on the crystal structure and composition of these phases is in progress; (2) Six intermediate phases have been isolated in the system V_2O_3 V_2O_5. Four of these phases have magnetic and electrical phase transitions; (3) Work has been started with the Sm-O system. SmO has been prepared by hydrogen reduction of Sm_2O_3. (4) The site preference (tetrahedral, octahedral) of Co and Ni ions in glass has been redetermined. While the Ni^{2+} to Ni^{3+} ratio increases with oxygen pressure, no measurable changes in the Cr^{2+} to Cr^{3+} ratio have been found.
Author (TAB)

N66-21118# Naval Research Lab., Washington, D. C.
SYNTHESIS OF NITROGEN FLUORIDES IN A NITROGEN PLASMA JET Final Report
B. R. Bronfin and R. N. Hazlett 12 Jan. 1966 16 p refs
(NRL-6340; AD-627787) CFSTI: HC $1.00/MF $0.50

Nitrogen-fluorine compounds have a high energy content, which makes them of interest in the propellant field. An electric arc technique, which has been used in the synthesis of other high-energy compounds, has now been applied to the nitrogen-fluorine system. A nitrogen plasma jet was intermixed with gaseous fluorides (CF_4 SF_6) and subsequently quenched. Small yields of NF_3, N_2F_4, and CF_3NF_2 were produced, together with trace quantities of other products. The observed products were accounted for by a reaction sequence involving the formation of FCN and its subsequent stepwise fluorination by addition at the triple bond. FCN is only an intermediate, however, and had not been found in the product stream. The yield of fixed-nitrogen products is about 1% of inlet nitrogen for typical conditions, and it increases with increasing power input and increasing F/N ratio in the plasma.
Author (TAB)

N66-21135# Bureau of Mines, Bartlesville, Okla. Petroleum Research Center.
THE MASS SPECTRA AND CORRELATIONS WITH STRUCTURE FOR 2-t-BUTYL-, 3-t-BUTYL-, 2,5-di-t-BUTYL-, AND 2,4-di-t-BUTYTHIOPHENES
Norman G. Foster 1966 39 p refs
(BM-RI-6741)

The mass spectra of four tertiary butyl substituted thiophenes are reported. A comparison and contrast with earlier structure correlations made by API-RP48 mass spectroscopists is presented. The fragmentation routes of these types of molecules are discussed and explained in terms of existing theories in mass spectrometry. Low ionization voltage data are presented to support the mechanistic picture developed. Structures are inferred about some of the ions, and these are correlated with existing theories. Metastable peaks in the spectra are used to support the fragmentation paths. The presence of doubly charged ions in the spectra is noted and the possible implications toward mechanisms discussed. The general picture of simple, small fragments leaving the ion moiety upon further fragmentation is developed in detail. Some suggestions are presented for further work utilizing isotopically labeled molecules to establish firmly the general picture of fragmentations of the alkylthiophenes.
Author

N66-21136# General Motors Corp., Anderson, Ind. Delco-Remy Div.
ZINC ELECTRODE INVESTIGATION Quarterly Technical Progress Report, 1 Jul.–1 Oct. 1964
J. J. Lander and J. A. Keralla 15 Oct. 1964 33 p
(Contract AF 33(615)-1583)
(QTPR-1; AD-606999) CFSTI: HC $2.00/MF $0.50

Initial experiments with one to five grams of a palladium-on-alumina catalyst for hydrogen-oxygen recombination in sealed cells was successful in maintaining low gas pressures for an 0.5 ampere overcharge condition for up to eight hours. Tin and lead impurities in the negative plate up to 5% were tested for their effects on cycle life. There was no observable effect, either beneficial or deleterious. Effects of silver impurities are uncertain. Cells containing negative plates formulated with broad ranges of composition of both polyethyleneoxide and polyvinyl alcohol were cycle-life tested. The results indicate that 2% polyvinyl alcohol gives best life and voltage performance. Other experimental work under way is described.
Author (TAB)

N66-21147# India. Dept. of Atomic Energy, Bombay.
ACTIVATION ANALYSIS THROUGH ADDITION OF 'STANDARD' AND SOLVENT EXTRACTION. PRINCIPLE OF THE METHOD
A. Alian 1965 10 p refs
(AEET-217) CFSTI: HC $1.00/MF $0.50

In activation analysis, the determination of chemical yield is necessary when losses in the different steps of chemical separations are significant. In some cases, the chemical yield determination cannot be made due to the non-availability of

suitable carriers. The present study describes a method for avoiding the correction for chemical yield, through addition of standard and solvent extraction. Author

N66-21149# Reactor Centrum Nederland, Petten.
TRANSPLUTONIDE RESEARCH Final Report, 1 Nov. 1961–31 Dec. 1964
A. van Dalen, W. Kraak, J. Van Ooyen, P. Polak, and J. C. Post (Inst. Voor Kernphys. Onderzoek) Brussels, EURATOM, 1966 77 p refs
(Contract EURATOM-005-61-11 TPUN)
(EUR-2640.e) CFSTI: HC $3.00/MF $0.75

Extraction of americium and rare earth elements from a 5 molar magnesium chloride solution into tertiary amine hydrochloride solution in xylene gave a separation factor of 100 between actinides and lanthanides. When nitrate ion was added to the aqueous phase to increase americium extraction, the separation factor decreased considerably. Paper electrophoresis in a complexing electrolyte medium was investigated as a method for the separation of americium, curium and rare earth elements. Author

N66-21152# Library of Congress, Washington, D. C. Aerospace Technology Div.
CHEMISTRY OF RARE EARTH AND ACTINIDE DERIVATIVES. TETRAPHYRROL PIGMENT DERIVATIVES OF RARE EARTH ELEMENTS AND ACTINIDES Surveys of Soviet Scientific and Technical Literature
Boris Nartsissov 4 Jan. 1966 45 p refs analytical survey
(ATD-66-1)

An annotated bibliography is presented on the tetrapyrrole pigment derivatives of rare earth elements and actinides. Included are reports in such major areas as luminescence, spectrophotometry, analytic chemistry, organic synthetic processes, chemical kinetics, photosynthesis, ion exchange, and chemical stability. C.T.C.

N66-21156# National Bureau of Standards, Washington, D. C.
ELECTROCHEMICAL ANALYSIS: STUDIES OF ACIDS, BASES, AND SALTS BY EMF, CONDUCTANCE, OPTICAL, AND KINETIC METHODS Annual Progress Report, 1 Jul. 1964–30 Jun. 1965
Roger G. Bates ed. 6 Sep. 1965 123 p refs
(NBS-TN-271) GPO: $0.60

A description of facilities and equipment is presented first and is followed by brief summaries of the several lines of work currently under way. Emphasis is given to the reasons why each study was undertaken. The main areas of investigation include the study of acidity and solvent effects in water, deuterium oxide, and water-methanol solvents by emf methods; the development of reference indicator bases for nonaqueous media and reference materials for dielectric measurements; measurement of the thermodynamic properties of mixed salt solutions; and investigation of special problems in trace analysis by conductometric and kinetic methods. Author

N66-21210# United Kingdom Atomic Energy Authority, Windscale (England). Production Group.
ANALYTICAL METHOD FOR THE DETERMINATION OF ACETONE AND METHYL ETHYL KETONE IN AQUEOUS SOLUTIONS (GAS CHROMATOGRAPHY)
1966 12 p
(PG-690(W)) HMSO: 1s 2d

A known weight of 1,4-dioxane is added to the sample. The mixture is chromatographed on a Celite column containing 10% of polyethylene glycol 400 at a temperature of 100°C. The peak height ratio of dioxane to acetone and dioxane to methyl ethyl ketone is then used to obtain the concentration of each ketone in the sample. Author

N66-21237# United Kingdom Atomic Energy Authority, Windscale (England). Production Group.
ANALYTICAL METHOD FOR THE DETERMINATION OF METHYLBENZENES IN HUMIDRIER LIQUORS (GAS CHROMATOGRAPHY)
1966 14 p
(PG-695(W)) HMSO: 1s 2d

Outlined is an analytical method, based on standard gas-chromatographic procedures, for the determination of methylbenzenes in humidrier liquors. The method, developed specifically for the analysis of Advanced Gas Cooled Reactor Humidrier Liquors, consists of mixing a known weight of the sample with a known weight of a standard solution of n-octane in n-hexane. An aliquot of this solution is injected into an Apeizon L/Celite chromatographic column held at 100°C. When the methylbenzenes have been eluted from the column the recorder chart is removed and the peak heights measured for those peaks assigned. After the required components have been eluted from the column the component peak heights relative to the marker peak height are used to determine the concentration of the methylbenzenes. M.R.W.

N66-21246# Aktiebolaget Atomenergi, Stockholm (Sweden).
AN AUTOMATED ANION-EXCHANGE METHOD FOR THE SELECTIVE SORPTION OF FIVE GROUPS OF TRACE ELEMENTS IN NEUTRON-IRRADIATED BIOLOGICAL MATERIAL
K. Samsahl Feb. 1966 19 p refs
(AE-215) CFSTI: HC $1.00/MF $0.50

An anion exchange method based on fast selective sorption steps from mixtures of sulfuric, hydrobromic, and hydrochloric acid solutions has been developed for the separation of five different groups of radioactive trace elements in neutron irradiated biological material. The separations are performed automatically with a simple proportioning pump apparatus. The apparatus allows the exact adjustment of influent solutions to the series of ion exchange columns. The practical application of the method is described in detail. The successful use of the method is practically independent on the level of ^{24}Na activity present in the sample. Author

N66-21262# Library of Congress, Washington, D. C. Aerospace Technology Div.
LUMINESCENCE OF COMPLEX MOLECULES—ANALYTICAL SURVEY Surveys of Soviet Scientific and Technical Literature
John J. Kourilo 18 Jan. 1966 113 p refs
(ATD-66-9)

This analytical survey is based on Soviet-Satellite open sources published in 1963. Part one contains a brief analytical survey of data. Section titles are as follows: (1) general studies (books, reviews, conferences, biographies); (2) physical state of matter; (3) lifetime of excited states and quantum yield of luminescence; (4) electronic spectra of luminescent complex molecules; (5) internal conversion and transfer of energy; and (6) applications of luminescence. Part two is an annotated bibliography on which the survey is based and which is arranged in the same sequence as the survey. The

selective annotations closely follow the text of the original papers without any comment added by the writer. Author

N66-21303# Picatinny Arsenal, Dover, N. J. Explosives Lab.
RADIATION-ENHANCED SURFACE ACTIVITY OF GAMMA HMX
Thomas C. Castorina, Jerome Haberman, and Andrew F. Smetana Feb. 1966 30 p refs
(PA-TR-3282; AD-627846) CFSTI: HC $2.00/MF $0.50

The surface activity of one-micron particle size gamma-octahydro-1,3,5,7-tetranitro-s-tetrazine (gamma-HMX) is enhanced by cobalt-60 gamma irradiation. Surface activity was measured by a radiometric determination of adsorption of carbon-14 labeled stearyl trimethyl ammonium bromide (STAB) from solution. At doses ranging from 5 to 60 Mrads, the enhanced surface activity is shown to be related to dose and the evolution of composite gaseous products derived from bulk as well as surface molecules. Although a one-Mrad irradiation of gamma-HMX in vacuo produces no change in surface activity, such as irradiation of gamma-HMX in contact with water vapor results in an enhancement of surface activity that is comparable to the effect of a 15-Mrad dose. Exposure of gamma-HMX to NO_2 and NO increases surface activity by 28% and 42%, respectively; irradiation of these samples with one Mrad gives no additional enhancement. The increased rate of thermal decomposition is not specific to radiation-enhanced surface activity promoted by water vapors but is found to be a function of gamma-ray interaction with bulk molecules as well. However, the increased rates of thermal decomposition of unirradiated samples of gamma-HMX exposed to NO and NO_2 are attributed solely to thermally unstable reaction products of NO-HMX and NO_2-HMX surface adducts.
Author (TAB)

N66-21314# Brown Univ., Providence, R. I. Engineering Div.
INVESTIGATION INTO TRANSITION METAL COMPOUNDS Final Report, 1 Nov. 1963–31 Oct. 1965
Aaron Wold Oct. 1965 70 p refs
(Contract AF 19(628)-3837)
(AFCRL-65-791; AD-625758) CFSTI: HC $3.00/MF $0.75

The topics included are: preparation and electrical properties of some thiospinels, structure and electrical properties of some monoclinic ternary sulfides, ternary chalcogenides of vanadium and chromium, crystallographic study of several chromium spinels, and vapor growth of aluminum oxide crystals.
TAB

N66-21319# Naval Research Lab., Washington, D. C.
SURFACE CHEMICAL DISPLACEMENT OF ORGANIC LIQUIDS FROM SOLID SURFACES Interim Report
Marianne K. Bernett and W. A. Zisman 15 Dec. 1965 25 p refs
(NRL-6354; AD-626804) CFSTI: HC $1.00/MF $0.50

An investigation was made of the various factors operative in the displacement by organic liquid compounds of a bulk layer of an nonaqueous liquid from a solid surface. Although the solid surfaces used in the experiments were SAE 1020 steel and borosilicate glass, the results are readily applied to any solids. The nonaqueous pure liquids displaced were selected to cover the surface tension range and included n-hexadecane, ar-dibromoethylbenzene, tricresyl phosphate, and propylene carbonate. A large number of well-defined displacing agents were investigated, of which the most efficient proved to be those where an optimum balance could be achieved between low surface tension, high equilibrium spreading pressure, and good solubility with respect to the organic substrate to be removed. Agents which were particularly effective for long-lasting or permanent displacement were certain classes of highly fluorinated organic compounds and low-molecular-weight dimethyl silicones. Low-surface-tension polar hydrocarbons, such as n-alkanols, were effective for temporary displacement. The several mechanisms operative in liquid-liquid displacement from solid surfaces were investigated. It was shown that these results and generalizations include our earlier results on water displacement as a special (and extreme) case.
Author (TAB)

N66-21331# General Electric Co., Philadelphia, Pa. Missile and Space Div.
RESEARCH ON ELECTRIC ARC REDUCTION OF CARBON DIOXIDE
Fred P. Rudek and Harold Warner Wright-Patterson AFB, Ohio. AMRL, Jul. 1964 46 p refs
(Contract AF 33(657)-11030)
(AMRL-TDR-64-62; AD-607039) CFSTI: HC $3.00/MF $0.75

A program of applied research was conducted to determine the applicability of reducing carbon dioxide by an electric arc process. Testing of an electric arc reactor in the laboratory indicated that carbon dioxide conversion rates up to 50 percent by weight per pass were readily attainable with an electric arc plasma generated by repeated capacitor discharges. Energy efficiencies obtained ranged as high as 98.9 percent, but at appreciable carbon dioxide flow rates the measured efficiencies were approximately 50 percent. Preliminary material balances indicate a reactor flow rate of 26.2 pounds per day with an energy input of 13 kW hours per day are required to process 6.6 pounds of carbon dioxide per day. The use of a plasma for carbon dioxide processing offers the advantages of high temperature gas processing (ie, arc temperatures to 5000K), while minimizing problems usually associated with high temperature reactors.
Author (TAB)

N66-21336# Army Electronics Labs., Fort Monmouth, N. J.
HIGH ENERGY ELECTROCHEMICAL BATTERY SYSTEMS USING ORGANIC ELECTROLYTES
Howard R. Knapp Oct. 1965 55 p refs
(ECOM-2632; AD-627215) CFSTI: HC $3.00/MF $0.50

Electrochemical studies on high energy anode and cathode materials coupled in organic electrolytes were undertaken to determine the feasibility of producing batteries superior to aqueous systems in the areas of (1) higher energy density per unit weight and volume, (2) wider temperature range of operation than aqueous batteries, and (3) lower operating temperature than aqueous batteries. The report covers the selection of couples for study in organic electrolytes. Statistical evaluation of half cell potential data at room temperature has disclosed inorganic acid anhydrides to be promising cathode materials in several organic electrolytes. Preliminary cell studies using lithium anodes, dimethyl sulfoxide electrolytes and acid anhydride cathode materials such as chromium trioxide, iodine pentoxide, molybdic oxide and vanadium pentoxide were made to characterize electrochemical performance of these materials.
Author (TAB)

N66-21357# IIT Research Inst., Chicago, Ill.
THERMODYNAMIC EVALUATION OF THE POSSIBILITY OF LITHIUM SUPEROXIDE PRODUCTION Final Report, 1 Feb.–29 May 1965

Richard H. Snow Wright-Patterson AFB, Ohio. AMRL. Aug. 1965 34 p refs
(Contract AF 33(615)-2351)
(AMRL-TR-65-126; IITRI-C6057-4; AD-626596) CFSTI: HC $2.00/MF $0.50

To determine whether lithium superoxide can be produced and whether it is stable enough for use in air regeneration units of manned spacecraft, the free energy of lithium superoxide was calculated from estimated values of the heat of formation, entropy, and heat capacity. The estimates were based on graphical comparison with properties of other oxides. The heat of formation was also determined from calculation of the lattice energy by means of the Born-Harber cycle. The result was −65 kcal. The stability of lithium superoxide was deduced by comparing graphically the free energies of the oxides of lithium. The superoxide is unstable by 15 kcal from 100° to 300°K and is even more unstable at higher temperatures. Reasonably high pressure and other effects cannot overcome this instability, even at low temperature. Therefore the use of lithium superoxide for air regeneration units is not promising. Author (TAB)

N66-21368# Army Electronics Labs., Fort Monmouth, N. J.
CHEMICAL FORMULAE OF MEASURED MATERIALS SHOWING THE PIEZOELECTRIC, ELECTROOPTIC, AND PIEZOOPTIC EFFECTS
Rudolf Bechmann Oct. 1965 23 p
(ECOM-2631; AD-624095) CFSTI: HC $1.00/MF $0.50

Chemical formulae of the materials for which all or part of the elastic piezoelectric, dielectric, piezooptic, and electrooptic constants are known and measured are listed. TAB

N66-21391# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIATION POLYMERIZATION OF n-HEPTENE IN PRESENCE OF $TiCl_4$
Yu. A. Kolbanovskiy, L. S. Polak, and E. B. Shlikhter 13 May, 1965 11 p refs Transl. into ENGLISH from Neftekhimiya (Russia), v. 3, no. 2, 1963 p 222–226
(FTD-TT-65-31; AD-615983) CFSTI: HC $1.00/MF $0.50

Radiation polymerization of n-heptene-1 was investigated in presence of $TiCl_4$, as well as the effect of dosage, dosage power and radiation temperature, amount of catalyst and dilution on the yield of the polymer. It was shown, that in diluted solutions and at lower temperatures, optimum conditions for polymerization with $TiCl_4$ are created. When calculating energy absorbed by monomer only, the values of radiation-chemical yield constitute approx. 50 mol/100 ev. It was established that the polymer yield depends upon dosage power in degree 0.6. Author (TAB)

N66-21414# Oregon Univ., Eugene.
1, 3-DIPOLAR ADDITIONS Final Report, Jul. 28, 1962–Jul. 27, 1965
V. Boekelheide (1965) 11 p
(Grant DA-ARO(D)-31-124-G377)
(AROD-3719-3; AD-622279) CFSTI: HC $1.00/MF $0.50

Investigations of dipolar addition reactions of heterocyclic organic nitrogen compounds were carried out. Four parent compounds were investigated. There were N-aminopyridenes, imidizoles, tetracyanoethylene oxide, and 4,8, diazapentalenes. TAB

N66-21419# Rock Island Arsenal Lab., Ill. Research and Engineering Div.
DEVELOPMENT OF AN IMPROVED RINSE SOLUTION FOR PHOSPHATE COATINGS THROUGH ADDITION OF ORGANIC ACIDS
William O. Crawford Jan. 1966 25 p refs
(RIA-66-67; AD-628072) CFSTI: HC $1.00/MF $0.50

Work was undertaken in order to improve the salt spray resistance capabilities of phosphate coatings through innovations in the post treatment of the phosphate coatings and specifically through improvements in the supplementary rinse solutions. Various compounds, both organic and inorganic, were tested in solution, both by themselves and in combination with each other and with the existing chromic acid rinse solution, as possible rinses for phosphate coatings. It was found that four different 1-4 and 1-5 dicarboxylic acids, when used in the proper concentration with the existing 0.6 gm/liter (0.08 oz./gal) chromic acid rinse increased the salt spray life of a phosphate coating by at least one hour over the salt spray life of a coating treated in the standard 0.6 gm/1 chromic acid rinse. These four acids are: citric acid, glutaric acid, maleic acid and succinic acid. It was also found that one aromatic dicarboxylic acid tested, phthalic acid, had the same effect on the salt spray life as the above mentioned aliphatic acids. Author (TAB)

N66-21428# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEVELOPMENT OF UKRAINIAN PETROLEUM CHEMISTRY PRESENT SCOPE AND ACCELERATED TEMPOS
P. Zherdetskiy 24 Sept. 1965 11 p Transl. into ENGLISH from Pravda Ukrainy (Moscow), 28 Jul. 1964 2 p
(FTD-TT-65-879/1+4; AD-622470) CFSTI: HC $1.00/MF $0.50

A discussion is given on the construction of petroleum refining plants in the Ukraine. This is made with reference to the construction of the Kremenchug plant, by citing problems that were encountered in this area. Mention is given to some of the technical aspects in the fabrication processes, and a delineation of anticipated problem areas and recommended actions are included. C.T.C.

N66-21440*# American Science and Engineering, Inc., Cambridge, Mass.
SURVEY OF EXTRATERRESTRIAL NON-SOLAR X-RADIATION BY ROCKET BORNE INSTRUMENTS Final Report
H. Gursky, R. Giacconi, and J. R. Waters (1965) 214 p refs
(Contract NASw-898)
(NASA-CR-71522; ASE-2017) CFSTI: HC $6.00/MF $1.25 CSCL 03A

The design, integration, and construction of two fully instrumented payloads to perform observations of X-rays originating from outside the solar system are reported. Also reported are the reduction and analysis of the data obtained during the Aerobee rocket flight of these payloads. A survey was made of the directional intensity on non-solar cosmic X-rays, a rough survey was obtained of their spectral composition between 10 Å and 0.1 Å, thermal and non-thermal components where distinguished, and regions of strong intensity were correlated with optical and radio objects of special interest. Appendices of reports published during this study are included, and give results of the rocket flights, as well as descriptions of the instrumentation. C.T.C.

N66-21441*# Hughes Aircraft Co., Culver City, Calif. Materials Technology Dept.
DEVELOPMENT OF IMPROVED STERILIZABLE POTTING AND ENCAPSULATING COMPOUNDS FOR SPACE APPLICATIONS Second Annual Summary Report, 1 Jul. 1964–30 Jun. 1965
Norman Bilow [1965] 84 p ref
(Contract NAS8-5499)
(NASA-CR-71523; P65-88) CFSTI: HC $3.00/MF $0.75 CSCL 07C

Two principal classes of polymers, siloxyurethanes and epoxysilicones, were investigated in a program to develop sterilizable electronic embedment materials and conformal coatings for use in an aerospace environment. With sioxyurethanes, principal effort was placed on the synthesis of siloxypolyols derived from trimethylolpropane and bis(hydroxymethyl) diphenyl ether. A study of siloxypolyols demonstrated that permanently stable polyol prepolymers were obtained only when the siloxane chains in the polyol were limited to an average of two to two and one-half silicon atoms. This short chain length proved too small to yield good dielectric materials. Several amine cured epoxy resins were also investigated, and it was noted that amines containing N-methylamino groups yield epoxies with much improved dielectric properties. This observation led to the synthesis of several N-methylaniline formaldehyde telomers which were found to yield cured epoxies with excellent dielectric properties.
C.T.C.

N66-21447# Joint Publications Research Service, Washington, D. C.
CATALYTIC SYSTEM OF METALS-TRANSITION METAL HALIDES FOR THE POLYMERIZATION OF a-OLEFINS
Chung-Huang Chu *In its* Transl. on Communist China's Sci. and Tech. 10 Mar. 1966 p 1–15 refs Transl. into ENGLISH from Hua Hsueh Tung Pao (Peking), no. 11, 1965 p 22–27 (See N66-21446 11-06) CFSTI: $3.00

A catalytic system consisting of a transition metal halide and a metal from group I through group III in low pressure polymerization of olefins was investigated. Compounds of a transition metal with small electronegativity and a metal with small radius were preactivated in an inert solution by heating or a mechanical method, and the metal alloys of Be, Mg, Zn, Al, etc., were used to stabilize the reaction. Violet $TiCl_3$ proved to be the best catalyst to obtain a crystalline isostatic a-polyolefin polymer with high molecular weight and high density from an industrial grade ethylene monomer at a yield ratio of 1000: 1. the isostatic polymer content was highest if the reaction was carried out at 0 to 30°C. G.G.

N66-21448# Joint Publications Research Service, Washington, D. C.
CHEMISTRY OF CARBODIIMIDES
Te-Chang Lu *In its* Transl. on Communist China's Sci. and Tech. 10 Mar. 1966 p 16–38 refs Transl. into ENGLISH from Hua Hsueh Tung Pao (Peking), no. 11, 1965 p 27–35 (See N66-21446 11-06) CFSTI: $3.00

An outline on synthesis, properties, and applications of carbodiimides is presented that concentrates on recent aspects of applications and developments. Carbodiimide acts as condensation agent in synthesizing processes by taking a hydrogen component from an active hydrogen compound and a hydroxyl group from another compound, thus eliminating a molecule of water and forming a new bond. Di-(3-toluene-)-carbodiimide and dicyclohexylcarbodiimide are poison to malignant bacteria and are widely used as pesticides. Some carbodiimides are also anti-carcinogenic in experimental mice. For the dye industry, carbodiimides are used as auxiliary dyestuffs to increase adhesive strength between dyestuffs and textiles; in the photoindustry, some water soluble carbodiimides are utilized to increase storage stability of films. In addition, carbodiimides remove fatty acids from neutral oil and fat. G.G.

N66-21469# Istituto Elettrotecnico Nazionale "Galileo Ferraris", Turin (Italy).
EXPERIMENTS OF AC-ELECTROLUMINESCENCE OF Cu DOPED ZnS SINGLE CRYSTALS Technical Note No. 5
G. Bonfiglioli, P. Brovetto, and A. Mojoni Sep. 1965 17 p refs Presented at the Intern. Symp. on Luminescence, Munich, 5–9 Sep. 1965
(Grant AF-EOAR-63-87)
(AFOSR-65-2098; AD-627470) CFSTI: HC $1.00/MF $0.50

The ac electroluminescence (EL) of Cu-doped ZnS single crystals is reported. Several aspects of a thermally induced aging effect are briefly described, which include evolution with the thermal treatment of the light-voltage relationship parameters, hardness increase, dislocations decoration, and optical microscope evidence of the conversion of the EL patterns from 'hairlike' to 'comet-shaped' form. Pictures are also shown, that give information as to the phase relationship of the light emitted from different specimen areas. The qualitative implications of these results as to the current theories are discussed, particularly their inconsistency with the mechansim of impact ionization. Author (TAB)

N66-21490# Leicester Univ. (England). Dept. of Chemistry.
THE EFFECT OF ADDED ELECTROLYTES ON THE E.S.R. AND OPTICAL ABSORPTION OF METAL-AMMONIA SOLUTIONS Final Report
M. C. R. Symons Jan. 1965 12 p refs
(Grant AF-EOAR-62-64)
(AFOSR-65-1938, Pt. 1; AD-627274) CFSTI: HC $1.00/MF $0.50

The electron spin resonance of solutions of alkali metals in liquid ammonia was studied as a function of the concentration of metal and of added alkali metal halides. When the concentration of metal is small (<0.01 m) there are small negative deviations in the g-factor for added chlorides and bromides but very large negative deviations for added iodides, the shifts for a given salt molality being then a function of the cation. The visible and near infrared absorption spectra of some of these solutions have been measured and the appearance of a shoulder in the 12,500 cm^{-1} region was confirmed. These results are discussed in terms of a specific interaction between unpaired electrons and iodide ions. Evidence that solvated electrons are quite strongly confined to cavities in the solvent is summarised, and a simple model is suggested which links the optical properties of solvated electrons to those of F centres in alkali-halide crystals and to those of solvated halide ions. Author (TAB)

N66-21505# Washington Univ., St. Louis, Mo. Dept. of Chemical Engineering
AN INVESTIGATION OF CARBON DEPOSITION Progress Report, 1 Nov. 1965–31 Jan. 1966
Eric Weger 2 Feb. 1966 3 p
(Contract AF 04(694)-695)
(PR-3; AD-627813) CFSTI: HC $1.00/MF $0.50

A brief summary is given of research on carbon deposition using an induction furnace. The pore structure characterization is discussed. TAB

N66-21508# National Research Corp., Cambridge, Mass. Norton Exploratory Research Div.
THERMOCHEMISTRY OF SELECTED COMPOUNDS Annual Summary Report, 15 Nov. 1964–14 Nov. 1965
Ludwig G. Fasolino 17 Jan. 1966 14 p
(Contract Nonr-3608(00))
(AD-627656) CFSTI: HC $1.00/MF $0.50

Aluminum borohydride and SAP were studied calorimetrically in an effort to derive their heats of formation. Much thermal and analytical data were collected in this search for the proper reaction conditions which will yield the useful informattion sought. The SAP material has reacted quickly and completely with water and the thermal data were consistent. The aluminum borohydride hydrolysis is our preferred reaction but as yet the results are not as consistent as desired. These hydrolysis studies are currently being carried out isothermally at 0° C. The analytical support data is most useful and essential in this study. Author (TAB)

N66-21513# Texas Instruments, Inc., Dallas. Semiconductor-Components Div.
THIN FILMS FORMED BY ELECTROCHEMICAL REACTIONS Quarterly Progress Report No. 7, 1 Jun.–31 Aug. 1965
R. Scot Clark and Mike Gaze Oct. 1965 61 p refs
(Contract DA-36-039-AMC-02324(E))
(TI-03-65-112; AD-627849) CFSTI: HC $3.00/MF $0.75

Basic investigations in the residual gas contamination during sputtering and oxidation mechanism have yielded information that contributes to increased process control. Also, the oxidation experiments depict a structure that can be modified to aid in temperature coefficient of resistance control. A process control investigation for fabricating 1000 ohms/sq resistors and >0.35 pF/sq mil capacitors on the same silicon substrate has been completed. The results show the yield for the 1000 ohms/sq±20% tolerance resistive film is 62% and for both the resistive and capactive films, the yield is 38%. An etch problem on the 455 KH_Z amplifier has delayed fabrication of this circuit. The problem has been solved by using a KMER mask to deposit the Ta_2O_5 dielectric through.
Author (TAB)

N66-21523# Picatinny Arsenal, Dover, N. J. Plastics and Packaging Lab.
PREPARATION OF POLYSILANES AND POLYSILARYLENES
E. A. Hoess and E. L. O'Brien Feb. 1966 17 p refs
(PA-TR-3289; AD-627319) CFSTI: HC $1.00/MF $0.50

The overall objective of the program is to prepare polymers which can serve as thermally stable structural adhesives of resins at service temperatures up to 538° C (1000° F). The report covers a portion of the work done on the synthesis of compounds containing Si-Si and Si-phenyl bonds. Dodecaphenylcyclohexansilane, polysilphenylene, and polysibiphenylene were prepared by the Wurtz-Fittig reaction. These molecules were identified and characterized. Author (TAB)

N66-21599# Laboratoires du Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
KINETIC STUDIES OF THE EXCHANGE ADSORPTION OF IONS FROM ACID SOLUTIONS ON AN INORGANIC ION EXCHANGER
D. Van Deyck and L. H. Baetsle Brussels, EURATOM, Feb. 1966 35 p refs
(Contract EURATOM-028-62-4 RISB)
(EUR-2748-e) CFSTI: HC $2.00/MF $0.50

The rate of attainment of equilibrium on ferrocyanide molybdate, an inorganic ion exchanger simultaneously, depends on the diffusion in the film surrounding the particle and in the solid phase itself. A method for discernating the contributions of both mechanisms is presented. No explanation could be found for the discrepancy between the experimental column capacity parameters and those derived from theoretical considerations. Author

N66-21665# Kernforschungsanlage, Juelich (West Germany).
MEASUREMENT OF THE DISTRIBUTION COEFFICIENT OF ACTINIDES AND LANTHANIDES BETWEEN AQUEOUS NITRIC ACID AND SOLUTIONS OF TRI-n-OCTYLPHOSPHINE OXIDE (TOPO) AND TRILAURYLAMINE (TLA) IN DIETHYLBENZENE SYNERGISTIC EFFECTS
H. Ihle, H. Michael, and A. Murrenhoff (Bonn Univ.), Brussels, EURATOM, Jan. 1966 25 p refs In GERMAN; ENGLISH summary Presented at the Primary Conf. of the German Chem. Assoc. and Kekule Festival, Bonn, 13–18 Sep. 1965
(Contract EURATOM-009-63-10 TPUD)
(EUR-2635.d) CFSTI: HC $1.00/MF $0.50

Coefficients for the distribution of Pu^{4+}, Am^{3+}, Cm^{3+} and Pm^{3+} between aqueous nitric acid and organic solutions of TOPO and TLA in diethylbenzene were measured as a function of the nitric-acid and lithium-nitrate concentration in the aqueous phase, the TOPO and TLA concentration in the organic phase, and the TOPO/TLA ratio in the organic phase. When a mixture of TOPO and TLA is used, the distribution coefficient is influenced by a synergistic effect. For the trivalent ions in the lithium-nitrate-containing system, the synergistic coefficient is greatest when the TOPO/TLA ratio in the organic phase is 1:10 to 1:100. The Am/Cm separation factor measured for TLA solutions without an admixture of TOPO is only slightly reduced by this small addition of TOPO, whereas the distribution coefficients can be substantially increased thereby. Without the addition of lithium nitrate to the aqueous phase, a negative synergistic coefficient was found in the measured range for the four ions investigated. Author

N66-21683*# National Bureau of Standards, Washington, D. C.
ELECTRON BEAM ELECTROLYSIS First Quarterly Status Report, 15 Nov. 1965–15 Feb. 1966
Abner Brenner and John Sligh 1 Mar. 1966 9 p
(Order R-09-022-052)
(NASA-CR-71557; NBS-9082) CFSTI: HC $1.00/MF $0.50
CSCL 07D

Attempts to electrolyze ceramic materials using an electron beam are reported. Electron beam electrolysis is a method of electrolytically decomposing either fused or solid salts or ionically conductive ceramics. The ionic materials rests on a metal contact which serves as anode and the cathodic lead is the stream of electrons which comes from a heated tungsten filament. Two electrolyses were conducted. In one experiment, solid nickel chloride was electrolyzed to yield nickel. In the other, sodium borate was electrolyzed. Attempts to electrolyze other ceramic materials (aluminum fluoride, magnesium phosphate, and aluminum phosphate) were not successful. M.R.W.

N66-21690*# National Aeronautics and Space Administration, Washington, D. C.
INFLUENCE OF CADMIUM ADDITIVES ON THE RATE OF THERMAL AND RADIOCHEMICAL DECOMPOSITION OF SILVER CARBONATE [VLIYANIYE DOBAVOK KADMIYA NA SKOROST' TERMICHESKOGO I RADIATSIONNO-KHIMICHESKOGO RAZLOZHENIYA KARBONATA SEREBRA]

Yu. A. Zakharov, V. V. Boldyrev, and A. A. Alekseenko Mar. 1966 7 p refs Transl. into ENGLISH from Kinetika i Kataliz (Moscow), v. 2, no. 3, May–Jun. 1961 p 365–367
(NASA-TT-F-10020) CFSTI: HC $1.00/MF $0.50 CSCL 07E

The addition of cadmium carbonate (2.5 mol. %) and its effect on the thermal decomposition of silver carbonate at 151°C, the radiochemical sensitization of the thermal decomposition process by prior x-irradiation, and the radiation decomposition of the carbonate under the influence of X-rays has been investigated. It has been established that the addition of 2.5 mol. % cadmium carbonate impurity to silver carbonate increases the rate of thermal and radiochemical decomposition of the silver carbonate. The hypothesis is advanced that the observed increase in the process rate may be attributed to an increase in the defect state of the silver carbonate crystals during addition of the purity. Author

N66-21750# Rock Island Arsenal Lab., Ill.
SYNTHESIS OF ELASTOMERS FROM EPOXIDES
Elmer I. Spearman Dec. 1965 16 p refs
(RIA-65-3417; AD-627308) CFSTI: HC $1.00/MF $0.50

Elastomeric oxypropylene terpolymers and copolymers which are resistant to petroleum base oils and flexible at low temperatures were synthesized using a ferric chloride–propylene oxide–water complex catalyst. Terpolymers of propylene oxide (PO)–Allyl Glycidyl ether (AGE)–polar monoepoxides varied from viscous liquids to rubbery solids. In general, their inherent viscosity increased as the polar monoepoxide concentration decreased. With PO–AGE based vulcanizates, improved tensile strength and elongation were obtained as the concentration of PO was increased. Vulcanizates based on 90% PO–8% AGE and 2% epichlorohydrin (EC/H) swelled 55% after immersion for 70 hours at 212°F. In Astm No. 3 oil and were non brittle at −40°C. High molecular weight terpolymers of PO–AGE–diepoxides were prepared. Unsaturated polar compounds (i.e., allyl cyanide, allyl sulfide) did not form terpolymers with PO–AGE. Author (TAB)

N66-21751# Clark Univ., Worcester, Mass.
TRANSITION METAL COMPLEXES AS POTENTIAL SEMICONDUCTORS
S. C. Kwan and A. M. Zwickel 31 Dec. 1965 114 p refs (Contract Nonr-3694(01))
(AD-627705) CFSTI: HC $4.00/MF $0.75

Electron transfer reaction mechanisms were studied through the measurement of the electrical properties of the coordination complex tris- (o-phenanthroline) iron (II)-hexachloroiridate and its analogs, as well as the organic ligands dipyridyl and orthophenanthroline. The plots of log C vs. 1/T for these complexes have a break in the curve, indicating the presence of both intrinsic and extrinsic conduction paths where C is the conductivity. The unusually high value for C at infinite temperature is shown to be consistent with a quantum mechanical tunneling model based on the formation of charge carriers and ion pairs from the neutral species constituting the microcrystallites. A current can be maintained when, under the influence of an electric field, the charge carriers undergo tunneling through a potential barrier formed at the edges of the microcrystallites. It is shown that a relationship between the mechanism for the conduction of these complexes and that for the organic ligands should exist. TAB

N66-21770*# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering.
LAW OF CORRESPONDING STATE FOR THE TRANSPORT PROPERTIES OF MOLTEN SALTS
K. D. Luks and H. Ted Davis [1965] 39 p refs (Grant NGR-24-005-063)
(NASA-CR-71387) CFSTI: HC $2.00/MF $0.50 CSCL 07D

A theory of corresponding states is developed for the transport properties of strictly ionic fused salts. Using a model ionic melt, laws of corresponding states are obtained by dimensional analysis of the autocorrelation function expressions for the transport coefficients. The theory parallels a previous treatment of simple non-ionic fluids. Agreement between experiment and theory for several alkali halides and alkali nitrates is encouraging. Author

N66-21793# Bureau of Mines, Reno, Nev.
ELECTROWINNING TUNGSTEN IN HALIDE AND PHOSPHATE ELECTROLYTES
John M. Gomes, Kenji Uchida, and Don H. Baker, Jr. 1966 17 p refs
(BM-RI-6742)

Two molten salt systems were evaluated as electrolytes for the repetitive recovery of tungsten from tungsten oxide (WO_3) made by calcining commercial-grade ammonium paratungstate. Using a sodium chloride-sodium fluoride-potassium aluminum tetrafluoride electrolyte at 800°C, 1 pound of 99.8 percent tungsten was recovered for each 2.7 kilowatt-hours of energy consumed. The metal contained 1,100 ppm carbon, was in dendritic masses of spherical grains, and had an apparent bulk density of 5.41 g/cm3. Tungsten of 99.9 percent purity was won from a sodium pyrophosphate-sodium tetraborate-sodium chloride electrolyte at 1,000°C; 6.0 kilowatt-hours of energy was consumed for each pound of metal recovered. The metal contained 120 ppm carbon, was in dendritic masses of hexagonal acicular crystals, and had an apparent bulk density of 7.25 g/cm3. Each metallic impurity—aluminum, calcium, copper, iron, nickel, and silicon—in the two tungsten products was 16 ppm or less. Author

N66-21795# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Stuttgart (West Germany).
ROTATIONAL ANALYSIS OF THE VISIBLE ABSORPTION BANDS OF FCL AND DETERMINATION OF THE V'NUMBERING [ROTATIONSANALYSE DER SICHTBAREN ABSORPTIONSBANDEN DES FCL UND ENDGULTIGE FESTLEGUNG DER V'-ZAHLUNG]
W. Stricker Jan. 1966 47 p refs In GERMAN; ENGLISH summary
(DVL-482; DLR-FB-66-04) CFSTI: HC $2.00/MF $0.50

This paper deals with three problems: (1) in connection with the investigation of irregular vibrational terms of diatomic molecules the absorption spectrum of FCl is examined in the region λλ 5200–4600 Å. Using a 5m Ebert spectrograph, the rotational structures of 27 bands of the $O^+ - X^1\Sigma^+$ transition are analyzed and their origins calculated. The system is extended by 10 further bands of FCl^{35} and 6 bands of the heavier isotope FCl^{37}. (2) the high dispersion of the spectrograph allows to measure the isotopic shift of 7 bands. This serves to confirm the numbering of the vibrational quantum of the O^+ term. (3) the accurate determination of the dissociation energy of the FCl molecule permits to calculate the dissociation energy of the F_2 molecule in the basic state. Author

N66-21801# National Bureau of Standards, Washington, D. C.
OXIDATION OF POLYCYCLIC, AROMATIC HYDROCARBONS A Review of the Literature
R. Stuart Tipson 17 Sep. 1965 57 p refs
(NBS-Monograph-87) GPO: $0.40

A survey has been made of the literature on the oxidation of polycyclic, aromatic hydrocarbons. Information has been assembled on (1) the oxidants effective in the oxidation of such hydrocarbons, (2) the relative reactivity of hydrocarbons, (3) the conditions under which oxidation proceeds, (4) the chemical mechanisms involved when such oxidations occur, and (5) the products formed. Author

N66-21806*# Notre Dame Univ., Ind. Dept. of Chemistry.
THE FUNDAMENTAL STUDIES ON THE SYNTHESIS OF HEAT-RESISTANT POLYMERS Summary Progress Report No. 10, 15 Sep. 1965-31 Jan. 1966
G. F. D'Alelio 15 Feb. 1966 95 p refs
(Grant NsG-334)
(NASA-CR-71529) CFSTI: HC $3.00/MF $0.75 CSCL 07C

This report covers work performed on three azine polymers prepared by the solution method, yielding infusible yellow brick-dust polymers, and by the melt method, yielding infusible, higher molecular weight black polymers. The azine polymers were shown to lose nitrogen upon heating and form a thermally stable polystilbene-type polymer. Therefore, thermoanalytical studies, employing thermal gravimetric analysis, differential thermal analyses and calorimetric analyses, were performed to monitor the parameters of the azine decomposition. Data on the weight-loss temperature ranges, the kinetics of decomposition and the extent of decomposition were obtained from the yellow polymers. Both the yellow solution and the black melt polymers were thermally evaluated by thermal gravimetric analyses to determine their relative stabilities in nitrogen and in air, both in relation to the method of synthesis and to the nature of the Ar moiety. The effect of particle size on thermal stability was simultaneously evaluated. Molecular weight determinations were performed on the yellow polymers by means of infrared studies, elemental analysis and viscometry; and an approximate DP for these yellow polymers obtained. Author

N66-21820*# Pennsylvania Univ., Philadelphia. Electrochemistry Lab.
STUDIES IN FUNDAMENTAL CHEMISTRY OF FUEL CELL REACTIONS Quarterly Progress Report, 1 Oct.-31 Dec. 1965
John O'M. Bockris [1965] 80 p refs *Its* Rept.-7
(Grant NsG-325)
(NASA-CR-71548) CFSTI: HC $3.00/MF $0.75 CSCL 07D

Progress is reported in various fundamental chemistry studies of fuel cell reactions. Considered are the mechanism of various types of high rate electrodes; the mechanism of electrocatalysis; the electric double layer at the solid-solution interface; adsorption in the double layer with specific reference to thermal effects; and electrode kinetic aspects of electrochemical energy conversion. Abstracts covering each area, and various graphs giving such data as volts versus amperes and current density versus overpotential are included. C.T.C.

N66-21822*# California Univ., Berkeley. Space Sciences Lab.
CONTINUOUS COUNTERCURRENT DIALYSIS OF LARGE VOLUMES
Stanley Mandeles and Ernest C. Woods [1965] 17 p refs Submitted for publication
(Grants NsG-479; NsG-600; NIH GM-12158-02)
(NASA-CR-71550) CFSTI: HC $1.00/MF $0.50 CSCL 07C

A simply fabricated, easily constructed continuous countercurrent dialyzer is described. Essentially, it consists of an inner dialysis tube (through which the retentate flows) concentric with an outer vinyl tube (through which the diffusate flows). The inner dialysis tube is held in place by plastic spacers at two foot intervals. This assembly can be extended for 20 to 30 feet, and is terminated at each end with a plastic connector that permits separate inflow and outflow retentate and diffusate. The performance of the dialyzer was tested with various solutes, and found efficient for the dialysis of comparatively large volumes. C.T.C.

N66-21826 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USE OF EPR (ELECTRON PARAMAGNETIC RESONANCE) FOR THE STUDY OF ACTIVE CENTERS IN LIQUID PHASE OXIDATION REACTIONS
Ya. A. Lebedev, V. F. Tsepalov, and V. Ya. Shlyapintokh 3 Jan. 1966 12 p refs Transl. into ENGLISH from the publ. "Tr. Soveshchaniya po Fizicheskim Metodam Issled. Organ. Soyedineniy i Khim. Protsessov, 10-17 Maya 1962" Frunze, Izd-Vo Ilim, 1964 p 190-195
(FTD-TT-65-1199/1+2+4; AD-627278) CFSTI: HC $1.00/MF $0.50

By the method of electron paramagnetic resonance cumene peroxide radicals were detected in the reaction of cumene oxidation, catalyzed by cobalt stearate or initiated azobisisobutyronnitrile and dicyclohexlpercarbonate. Stationary concentrations of radicals were measued at various initiation rates in conditions of going oxidation reaction. The concentration of perioxide radicals, calculated by known values of rates of initiation and by the value of recombination velocity constant, are measured. Author (TAB)

N66-21827# Milan Univ. (Italy). Inst. of General Chemistry.
COMPLEX HYDRIDES AND ZEROVALENT DERIVATIVES OF TRANSITION METALS Final Report
Lamberto Malatesta 1 Nov. 1965 49 p refs
(Grant AF-EOAR-64-9)
(AFOSR-65-2717; AD-627812)

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N66-21832# Western Ontario Univ., London. Molecular Excitation Group.
IDENTIFICATION ATLAS OF MOLECULAR SPECTRA. 2: THE N_2 $C^3\Pi_u$-$B^3\Pi_g$ SECOND POSITIVE SYSTEM
D. C. Tyte and R. W. Nicholls 31 Oct. 1964 19 p refs
(AD-627814) CFSTI: HC $1.00/MF $0.50

This report contains a set of vibrationally identified spectrograms of the Second Positive ($C\ ^3\Pi_u$-$B\ ^3\Pi_g$) system of N_2. A compilation of all the available molecular data

on the states involved, a brief description of the appearance, occurrence and history of the system and a selected bibliography are also included. Author (TAB)

N66-21833# Northeastern Univ., Boston, Mass. Photochemistry and Spectroscopy Lab.
APPARATUS FOR FLASH PHOTOLYSIS Scientific Report No. 3
Peter A. Schnieper Jul. 1965 51 p refs
(Contract AF 19(628)-3836; Grant PHS-RH-00302-02)
(PSL-102; AFCRL-65-716; AD-627533) CFSTI: HC $3.00/MF $0.50

Flash photolysis provides a means of studying the short-lived chemical intermediates which result from exposure to light. The paper describes the instrumentation for this technique developed at Northeastern University. Details are presented of the main discharge circuit, of the flash tubes, and of the trigger, delay, and detection circuits. A flash photolysis assembly based on the pulsed ruby laser is also described. The photolysis of aqueous methylene blue serves to illustrate the performance of the apparatus. Author (TAB)

N66-21840# Army Foreign Science and Technology Center, Washington, D. C.
STUDY OF THE DEVELOPING PROPERTIES OF 1-PHENYLPYRAZOLIDONE-3 AND ITS DERIVATIVES
V. L. Abritain Dec. 1965 9 p refs Transl. into ENGLISH from Zh. Nauch. i Priklad. Fot. i Kinematografii (Moscow), v. 9, no. 5, Sep.–Oct. 1964 p 333–336
(FSTC-381-T65-663; AD-627916) CFSTI: HC $1.00/MF $0.50

The superadditive effect of phenidone (1-phenyl-3-pyrazolidone) with various developing compounds more frequently used in photographic practice was studied. Studied as basic developing compounds were: adurole (chlorhydroquinone), amidole (2,4-diaminophenol hydrochloride), hydroquinone, glycine (p-oxiphenylglycine), methole (monomethyl-p-aminophenol), p-aminophenol, p-phenylenediamine, pyrocatechol and pyrogallol. It is shown that a superadditive effect of phenidone is found chiefly with developing compounds containing at least two oxigroups in the molecule (exception—glycine, one oxigroup). TAB

N66-21881# Massachusetts Inst. of Tech., Cambridge. Dept. of Nutrition and Food Science.
THE ROLE OF AMINO CARBOXYLIC COMPOUNDS AS OXIDATION INHIBITORS IN DEHYDRATED SYSTEMS Technical Report, Apr. 1964–Apr. 1965
M. Karel and S. Tannenbaum Natick, Mass., Army Natick Labs., Dec. 1965 90 p refs
(Contract DA-19-129-AMC-254(N))
(FD-36; AD-626176) CFSTI: HC $3.00/MF $0.75

Oxidation of methyl linoleate was studied in a freeze-dried model system based on microcrystalline cellulose, in the presence and in the absence of amino carboxylic compounds added in concentrations ranging from .001 to .04 moles per mole of linoleate. It was observed that several amino carboxylic compounds had substantial antioxidant activity. Compounds for which such activity was observed included: histidine, cysteine, alanine, lysine, beta amino butyric acid, gamma amino butyric acid, and epsilon amino caproic acid; whereas no antioxidant activity was observed with methionine, arginine, phenylalanine and isoleucine. The nature of the antioxidant activity of the amino compounds was found to be different from that observed in the identical system with a phenolic antioxidant, since the main effect of the amino compound was to prolong the induction period, but the phenolic compound prolonged the induction period, and in addition reduced the rate of oxidation throughout the course of oxidation. Work was undertaken on the separation and characterization of reaction products from model systems containing linoleate and amino compounds. Reaction products in the model system oxidized in the presence of linoleate and histidine were studied using radioactive tracer compounds. TAB

N66-21898# ARO, Inc., Arnold Air Force Station, Tenn.
A TECHNIQUE FOR MEASURING CAPTURE COEFFICIENTS AND APPLICATION TO THE MEASUREMENT OF HYDROGEN ADSORPTION BY TITANIUM Technical Report, May–Aug. 1964
T. L. Moody Arnold Eng. Develop. Center, Feb. 1966 45 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-65-123; AD-628380) CFSTI: HC $2.00/MF $0.50

The problems encountered in making capture coefficient measurements are reviewed, and a new experimental technique, employing a rotating gage, is presented. Utilizing this technique, the fraction of impinging hydrogen molecules removed by a continuously deposited titanium surface was determined as a function of the titanium evaporation rate and gas flux. The results demonstrate that there is little to be gained by evaporating more than one atom of titanium for each atom of hydrogen. Author (TAB)

N66-21932# Oak Ridge National Lab., Tenn.
INTERACTION OF THERMAL ELECTRONS WITH POLARIZABLE AND POLAR MOLECULES
L. G. Christophorou, A. Hadjiantoniou (M.S. Thesis—Vanderbilt Univ.), and G. S. Hurst Nov. 1965 79 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1262) CFSTI: HC $3.00/MF $0.75

The electron swarm technique was used to study electron transport in several gases of both the polar and polarizable classes. Measurements were made of free electron drift velocities, W, the ratio W/D where D is the diffusion coefficient, and the attachment coefficient. From the measurement of W or D the cross section for momentum transfer was deduced. Ethylene was used as a carrier gas to provide a swarm of thermal electrons (low E/P). The nonpolar gases N_2, CO_2, C_2H_4, C_3H_8, C_4H_{10}, C_5H_{12}, and C_6H_6 were studied without carrier gas. Other nonpolar molecules, such as propane, pentane, hexane, heptane, octane, nonane, decane, benzene, cyclohexane, p-xylene, and p-dichlorobenzene, and polar molecules, such as m-xylene, o-xylene, o-bromotoluene, m-dichlorobenzene, bromobenzene, chlorobenzene, and o-dichlorobenzene were studied with carrier gas. It was found that the Altshuler theory and experimental results are in relative agreement, which becomes better for small molecules with large permanent dipole moments. NSA

N66-21943# California Univ., Berkeley. Lawrence Radiation Lab.
THE KINETICS OF THE HIGH-TEMPERATURE-LOW PRESSURE TUNGSTEN-NITROUS OXIDE REACTION
Gerald L. De Poorter (Ph.D. Thesis) 24 May 1965 56 p refs
(Contract W-7405-ENG-48)
(UCRL-16019) CFSTI: HC $3.00/MF $0.50

The kinetics of the tungsten–nitrous oxide reaction were studied at temperatures between 2100 and 2900°K and at gas pressures between 3×10^{-9} and 10^{-6} atm. The reaction was

studied under molecular flow conditions by leaking nitrous oxide into an evacuated chamber containing an electrically heated tungsten filament. The decomposition of the nitrous oxide was followed by measuring the partial pressure of nitrous oxide, nitrogen, and molecular oxygen with a mass spectrometer connected into the system. The rate of tungsten oxidation was determined by following the change in the filament resistance as a function of time for constant temperature and pressure. On the basis of the results of other investigations, $WO_2(g)$ was assumed to be the principal oxide formed. The principal reaction is decomposition of nitrous oxide, which is unaffected by excess nitrogen but greatly reduced by excess oxygen. About one in a thousand nitrous oxide molecules that strike the surface reacts to form $WO_2(g)$ at a tungsten temperature of 2220°K and a nitrous oxide pressure of 10^{-6} atm, whereas at 2735°K and 10^{-8} atm, one in fifty nitrous oxide molecules that strike the surface is converted to $WO_2(g)$. The results of this investigation are consistent with a six-step reaction mechanism involving: (a) physical adsorption of the nitrous oxide, (b) partial evaporation of the physically adsorbed nitrous oxide, (c) decomposition of the physically adsorbed nitrous oxide molecules into nitrogen gas and chemisorbed oxygen atoms, (d) reaction of the physically adsorbed nitrous oxide molecules with chemisorbed oxygen atoms, producing molecular nitrogen and oxygen, (e) evaporation of the chemisorbed oxygen atoms, and (f) reaction of two chemisorbed oxygen atoms with the tungsten, giving $WO_2(g)$. The decomposition rate of N_2O and the rate of formation of WO_2 both increase with increasing temperature and pressure. Author

N66-22011# State Univ. of New York Research Foundation, Albany.

DISPLACEMENT AND EXCHANGE REACTIONS INVOLVING ORGANOMETALLIC COMPOUNDS Final Report

Henry G. Kuivila 15 Oct. 1965 18 p

(Contract AT(30-1)-3453)

(NYO-3453-1) CFSTI: HC $1.00/MF $0.50

A study of the protonolysis of allyltins was extended to include examination of kinetic isotope effects, determination of activation parameters, and the effects of metal ions on rate. The results on activation parameters indicated a very large compensation effect between enthalpies and entropies of activation. For the effects of substitution on tin the trend can be interpreted in terms of decreasing solvation with increased bulk of substituents on the tin atom accompanied by an increase in the enthalpy of activation in the same direction. Solvent kinetic isotope effects showed quite convincingly that the proton transfer occurs in the rate determining step of the reaction. Metal ion catalysis was found to compete less well with the protonolysis reaction than it does in the protodeboronation of areneboronic acids previously reported. NSA

N66-22026# California Univ., Berkeley. Lawrence Radiation Lab.

REACTION DISTRIBUTION IN A POROUS ANODE

Richard Collin Alkire (M.S. Thesis) Jun. 1965 70 p refs

(Contract W-7405-ENG-48)

(UCRL-16113) CFSTI: HC $3.00/MF $0.75

An experimental technique was developed for measuring the reaction distribution within flooded porous electrodes in which there is no bulk flow of electrolyte in the pores. A porous metal anode is dissolved electrolytically forming soluble reaction products. The porosity of the electrode, uniform prior to electrolysis, is determined after electrolysis by a microscopic examination. The change in porosity distribution is equivalent to the time-average reaction distribution during electrolysis. The design of the experiment is such that electrolysis proceeds in a manner which is well characterized. The acid copper system was used for study. Six experiments were conducted to investigate the capabilities and limitations of the method. It was found that reaction distributions can be determined which are in qualitative agreement with present theories. Author (NSA)

N66-22030# California Univ., Berkeley. Lawrence Radiation Lab.

CARBOTHERMIC REDUCTION OF ALUMINA: A THERMODYNAMIC ANALYSIS

Wayne L. Worrell 7 Oct. 1964 17 p refs

(Contract W-7405-ENG-48)

(UCRL-11699) CFSTI: HC $1.00/MF $0.50

Using new thermodynamic data for Al_4C_3, stability relationships in the Al–C–O system were determined. A Pourbaix–Ellingham diagram was constructed and is used to evaluate the equilibrium carbothermic reduction process. The analysis indicates that liquid aluminum can never be obtained and that appreciable amounts of $Al_2O(g)$ are present in the vapor. An analysis is also made of an alternate reduction path in which aluminum vapor is produced by the decomposition of aluminum carbide. The Al_4O_4C and Al_2OC oxycarbide phases are considered to be metastable, but their possible influence on the equilibrium reduction process is briefly discussed. Author (NSA)

N66-22050# Oak Ridge National Lab., Tenn.

EQUILIBRIUM BETWEEN CERIUM AND ITS DIVALENT AND TRIVALENT IONS IN A MOLTEN EUTECTIC MIXTURE OF LITHIUM AND POTASSIUM CHLORIDES

M. V. Smirnov, Yu. S. Sokolovskii, and Yu. N. Krasnov 20 Apr. 1965 13 p refs Transl. into ENGLISH from Tr. Inst. Elektrokhim., Akad. Nauk SSSR, Ural'sk. Filial (Sverdlovsk), v. 5, 1964 p 7–16

(ORNL-TR-578) CFSTI: HC $1.00/MF $0.50

The equilibrium potentials of Ce in molten eutectic LiCl–KCl containing 0.84, 1.65, and 5.62 wt % Ce at 400 to 700°C were measured. The average valence of Ce in the melt is less than 3. The standard electrode potentials were determined to be: $E^{\circ}_{Ce/Ce^{3+}} = -3.61 + 7.4\times10^{-4}T \pm 0.01$ volt and $E^{\circ}_{Ce/Ce^{2+}} = -3.36 + 5.8\times10^{-4}T \pm 0.02$ volt. The equilibrium constant of the reaction $2\ Ce^{3+}$ (molten) + Ce(solid) → $3\ Ce^{2+}$(molten) is $\log[Ce^{2+}]^3/[Ce^{3+}]^2 = 4.84 - 7560/T$. The thermodynamics of $CeCl_2$ was investigated; it was found that liquid $CeCl_2$ cannot exist in the free state. Author (NSA)

N66-22056# California Univ., Berkeley. Lawrence Radiation Lab.

ELECTRON SPIN RESONANCE STUDIES OF TRANSITION METAL ION COMPLEXES

John Brockett Spencer (Ph.D. Thesis) Aug. 1965 127 p refs

(Contract W-7405-ENG-48)

(UCRL-16175) CFSTI: HC $4.00/MF $0.75

The spectrum of $Cr(CN)_5NO^{-3}$ was examined in solution and in a glass using enriched $^{13}CN^-$. The isotropic hyper-fine coupling constants were determined to be $A(^{53}Cr) = 18.39$ gauss, $A(^{14}N) = 5.27$ gauss for the NO ligand, $A(^{13}C_a) = 8.80$ gauss, and $A(^{13}C_e) = 12.64$ gauss for the axial and equatorial CN ligands. The anisotropic magnetic parameters determined were $A_\perp(^{53}Cr) = 11.6 \times 10^{-4}$ cm^{-1}, $A_\parallel(^{53}Cr) = 30.9 \times 10^{-4}$ cm^{-1}, $A_\perp(^{14}N) = 6.3 \times 10^{-4}$ cm^{-1}, $A_\perp(^{13}C_e) = 9.2 \times 10^{-4}$ cm^{-1}, $A_\perp(^{13}C_e) = 11.0 \times 10^{-4}$ cm^{-1}, $g_\perp = 2.006$, and $g_\parallel = 1.973$. The rate of exchange of $^{13}CN^-$ with $Cr(CN)_5NO^{-3}$ was determined in the temperature range 60–100°C from

changes in the ESR spectrum. The results obtained were $k_a = 6 \times 10^{-6}$ sec^{-1} at 75°C with $\Delta H_a^{\ddagger} = 33.5$ kcal/mole and $\Delta S_a^{\ddagger} = +18$ eu for axial exchange; and $k_e = 6 \times 10^{-6}$ sec^{-1} with $\Delta H_e^{\ddagger}$ 30.5 kcal/mole and $\Delta S_e^{\ddagger} = +5$ eu for equatorial exchange. Implications for bonding in this complex are discussed. Solution and glass spectra for cupric ion in water and in ammonia were investigated. The magnetic parameters determined were $g_{||} = 2.379$, $g_{\perp} = 2.066$, $A_{||} = 155 \times 10^{-4}$ cm^{-1}, and g = 2.199 in water; and $g_{||} = 2.228$, $g_{\perp} = 2.055$, $A_{||} = 192 \times 10^{-4}$ cm^{-1}, g = 2.124, and $A = 69 \times 10^{-4}$ cm^{-1} in ammonia. Line widths for cupric ion in water were measured from −40 to +200°C and in liquid ammonia from −80 to +20°C. The line widths were corrected for unresolved hyperfine structure. Two contributions to the line width were distinguished. One contribution increases with increasing temperature and is the same for all four hyperfine components. The second increases with decreasing temperature and varies with the hyperfine component. A transition region was observed for cupric ion in ammonia between −80 and −100°C. In this region the sample was frozen but an isotropic spectrum was obtained. These results are discussed with regard to several theories of electron spin relaxation. Glass spectra for ferric chloride in concentrated HCl and concentrated $HClO_4$ were examined. A sharp resonance at g = 4.24 was observed and assigned to the species $FeCl_4^-$. The theory for high g-value resonances in ferric complexes is reviewed and applied to $FeCl_4^-$. Glass spectra for the chromic complexes $CrCl(H_2O)_5^{+2}$, cis- and trans-$CrCl_2(H_2O)_4^+$ were examined and compared with the spectrum for $Cr(H_2O)_6^{+3}$. The spectra for the chloro complexes extend from g = 6 to g = 2. The results are discussed in terms of zero field energies and symmetries of the complexes.
Author (NSA)

N66-22060# Oak Ridge National Lab., Tenn. Reactor Chemistry Div.

RADIOCHEMICAL MEASUREMENTS OF THE SOLUBILITY OF ALKALINE EARTH SULFATES IN WATER AND IN SODIUM SULFATE SOLUTIONS

K. H. Lieser Feb. 1965 14 p refs Transl. into ENGLISH from Z. Anorg. Allgem. Chem. (Leipzig), v. 335, pt. 5-6, Feb. 1965 p 225-236
(ORNL-TR-649)

The solubility of $BaSO_4$ (traced with ^{140}Ba) and of strontium sulfate (traced with ^{90}Sr) in water and in sodium sulfate solution of various concentrations were measured radiochemically. The solubility of $CaSO_4 \cdot 2H_2O$ in sodium sulfate and sulfuric acid of various concentrations were determined through titrations. The mathematical analysis of the solubility curves indicates that, in saturated solutions of strontium sulfate and calcium sulfate in water, a relatively higher proportion of neutral molecules or ion aggregates are present. A complex formation involving sulfate ion was not recognizable. Author

N66-22070# Sandia Corp., Albuquerque, N. Mex.

TIME RESOLVED MASS SPECTROMETRY WITH THE BENDIX TOF MASS SPECTROMETER

R. T. Meyer and J. M. Freese Jul. 1965 9 p refs Presented at the 13 Ann. Conf. of the Am. Soc. of Testing Mater., St. Louis
(Contract AT(29-1)-789)
(SC-R-65-956; CONF-650519-2) CFSTI: HC $1.00/MF $0.50

Adaptation of the mass spectrometric technique to kinetic analyses of transient chemical processes has been limited by low sensitivity for the detection of intermediate species, by long transit paths between the high pressure reaction zone and the low pressure ionization zone, and, in the case of flash photolysis experiments, by a low photochemical conversion efficiency. The present work provided greatly improved performance of a Bendix TOF mass spectrometer for ion generation, transmission, and detection. An ultimate single cycle sensitivity of 1 part in 100,000 was obtained for pulsed operation at 20 kc. This corresponds typically to an absolute abundance of a reactive species of 0.5×10^{-7} mole/liter. Bimolecular reactions with rate constants approaching 10^{11} liter mole^{-1} sec^{-1} may be studied with this sensitivity and time resolution. A short transit path of 2 mm is achieved with a reaction vessel fitted into the Bendix ion source and containing a conical, ground glass sampling orifice. Geometrical coupling of the flash lamp and the reaction vessel permitted efficient transfer of the ultraviolet radiation to the absorbing gases. An incident light flux of 3×10^{18} quanta/cm^2 for the wavelength band 2000 to 4000 Å was measured by nitrogen dioxide actinometry. Author (NSA)

N66-22081# Union Carbide Nuclear Co., Paducah, Ky.

A CHROMATOGRAPH FOR THE ANALYSIS OF HIGHLY REACTIVE AND CORROSIVE COMPOUNDS

E. L. Williamson, C. M. Johnson, T. J. Mayo, and W. R. Rossmassler 8 Jul. 1965 21 p refs
(Contract W-7405-ENG-26)
(KY-485) CFSTI: HC $1.00/MF $0.50

A chromatograph for the analysis of corrosive gases was designed, built, and tested. The instrument features a unique sample valve and a bleed to the carrier system to improve the analysis for hydrofluoric acid. Data on several individual and mixed gases are tabulated. Author (NSA)

N66-22088# California Univ., Berkeley. Lawrence Radiation Lab.

THE ANALYSIS OF THE NUCLEAR MAGNETIC RESONANCE SPECTRA OF FOUR-MEMBERED RING COMPOUNDS OF THE TYPE A_2B_4 USING BOTH COMPUTER AND DOUBLE-IRRADIATION TECHNIQUES

James A. Ferretti (Ph.D. Thesis) Aug. 1965 135 p refs
(Contract W-7405-ENG-48)
(UCRL-16349) CFSTI: HC $4.00/MF $1.00

The nuclear magnetic resonance spectra of a series of four-membered ring molecules were analyzed using both computer and double-irradiation techniques. The molecules, trimethylene oxide, trimethylene imine, trimethylene sulfide, and 1,1-dimethylcyclobutanedicarboxylate, were analyzed as A_2B_4 systems. The chemical shifts and vicinal and long range coupling constants were found to be quite normal. Current theories concerning substituent effects on geminal proton coupling constants are presented and the substitutive trends observed in the above series are interpreted in the light of these theories. The effects of bond hybridization on substituent effects were also found to be interpretable in terms of the theory. Nuclear magnetic double resonance spectra were observed both by sweeping the observing r-f field ν_1 and also by sweeping the perturbing field ν_2. When ν_1 is set on a non-degenerate transition frequency and ν_2 subsequently swept to perturb the other lines in the spectrum, intensity changes are observed when any transition which is perturbed by ν_2 has an energy level in common with the line being observed by ν_1. An intensity increase is observed when the energy levels are ordered in a progressive manner and a decrease in intensity is observed when the energy levels are ordered in a regressive manner. This procedure has been used to establish the ordering of the energy levels of the ABC system of protons in 2-chlorothiophene. Pulse experiments

were carried out in order to gain a fuller understanding of the phenomena observed in the above double-resonance experiments. These experiments indicate that the observed phenomena are caused by population inversion due to adiabatic rapid passage. A detailed description of the field-frequency spectrometer constructed and used in the above work is presented.
Author (NSA)

N66-22106# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
SEARCH FOR DEPENDENCE OF DOPPLER BROADENING OF NEUTRON RESONANCES ON CHEMICAL BINDING. THE 405 V RESONANCE FOR Cl^{35} [POISKI ZAVISIMOSTI DOPPLEROVSKOGO USHIRENIYA NEITRONNYKH REZONANSOV OT KHIMICHISKOI SVAYAZI. REZONANS 405 EV Cl^{35}]
E. N. Karzhavina, A. B. Popov, I. I. Sheltontsev, and Yu. C. Yazvitskii. 1965 14 p refs In RUSSIAN
(JINR-P-2198)

Using a neutron spectrometer the curves of transmission and self-indication were measured for NaCl samples of several thicknesses. These data were employed to estimate the values $g\Gamma_n$ and Γ for the 405 ev resonance for ^{35}Cl which were found to be 0.037 ± 0.002 and 0.82 ± 0.09 ev, respectively. The curves of transmission for the samples NaCl, CCl_4, $PbCl_2$ with the same thicknesses for ^{35}Cl were also measured at the temperature of 300 and 80°K. The areas of the 405 ev resonance for ^{35}Cl obtained with NaCl, CCl_4, $PbCl_2$ at T=300°K and with the sample CCl_4 at T=300°K were equal in the limits of experimental accuracy (~1.5%). The cooling of the NaCl sample from 300 to 80°K led to the area reduction by 10%.
Author (NSA)

N66-22109# Yeshiva Univ., New York. Belfer Graduate School of Science.
STABLE ISOTOPE STUDIES Annual Progress Report, 15 Sep. 1964–15 Jul. 1965
T. Hughes, Lois Nash Kander, E. U. Monse, and W. Spindel 15 Jul. 1965 36 p refs
(Contract AT(30-1)-3462)
(NYO-3462-1) CFSTI: HC $2.00/MF $0.50

Isotopic exchange equilibria and partition function ratios were calculated with a high speed digital computer. Molecules studied include NO, NO_2^+, NO_2, NOF, NOCl, NOBr, NO_2F, NO_2Cl, NO_3^-, HNO_3, and *cis* and *trans* nitrous acids. In the course of the calculations, force fields were calculated for several species from recent spectroscopic data, and in several cases force fields still unpublished were used to calculate vibrational frequency shifts on isotopic substitution. Where sufficient spectroscopic data were available, isotopic partition function ratios were calculated from both fundamental and zero-order frequencies, to permit an evaluation of anharmonicity on the ratios. Many of these calculations are still in progress.
Author (NSA)

N66-22112# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
THERMOCHEMICAL DEPOSITION OF REFRACTORY METALS, ALLOYS, AND COMPOUNDS FOR APPLICATION IN THERMIONIC DEVICES
J. I. Federer, R. L. Heestand, F. H. Patterson, and C. F. Leitten, Jr. (1965) 13 p refs Presented at the Intern. Conf. on Thermionic Elec. Power Generation, London, 20–24 Sep. 1965
(Contract W-7405-ENG-26)
(ORNL-P-1446-1; CONF-650908-9) CFSTI: HC $1.00/MF $0.50

Thermionic devices impose rigid requirements on refractory materials technology in relation to fabrication, purity, and physical characteristics. Thermochemical deposition of refractory metals, alloys, and compounds was investigated as a technique for solving these materials problems. Tubular and sheet deposits of W, Re, Mo, and W–Re alloys were prepared by H_2 reduction of the metal hexafluorides in the temperature range 500 to 1000°C at pressures of 5 to 20 torr. Factors affecting deposition rates, purity, and grain orientation were studied. High-purity W sheet of uniform thickness was prepared at about 570°C. W deposited below 800°C is highly oriented with [100] parallel to the deposition surface. Joining of thermochemically deposited and wrought W by deposition was demonstrated by the preparation of joints in sheet and tubing. W–Re alloys deposited in a static hot zone at temperatures of 450 to 700°C are inherently nonuniform in composition and deposition rates due to relative differences in the stabilities of WF_6 and ReF_6. A moving hot-zone technique shows promise of alleviating this problem. UO_2 having oxygen-to-uranium ratios ranging from 2.001 to 2.166 was deposited by reaction of UF_6 with H_2 and water vapor or O_2 at 1250 and 1300°C and pressures of 3 to 6 torr. Both bulk solids and extremely fine powder (60 to 200 Å) were prepared. Stoichiometric SiC was deposited at a rate of 10 mils/hr by H_2 reduction of $SiCl_4$ in the presence of methane at 1300°C and a pressure of 100 torr. In general, thermochemical deposition is a unique method for fabricating many refractory materials of high density and purity and requiring a minimum of finishing operations.
Author (NSA)

N66-22117# Mound Lab., Miamisburg, Ohio.
DETERMINATION OF TERTIARY BUTYL PERBENZOATE IN MOLDING POWDERS
L. W. Hartzel (1965) 4 p ref
(Contract AT(33-1)-GEN-53)
(NLM-1284) CFSTI: HC $1.00/MF $0.50

Sully's method for the iodimetric determination of organic peroxides was adapted for tertiary butyl perbenzoate in thermosetting diallyl phthalate molding powder. Results are reported for unfilled and filled formulations.
NSA

N66-22128# Los Alamos Scientific Lab., N. Mex.
THE X-RAY FLUORESCENCE SPECTROMETRIC DETERMINATION OF CADMIUM IN SILVER-CADMIUM-COPPER ALLOYS
E. A. Hakkila, R. G. Hurley, and G. R. Waterbury 23 Jun. 1965 17 p refs
(Contract W-7405-ENG-36)
(LA-3305) CFSTI: HC $1.00/MF $0.50

Cadmium in silver–cadmium–copper alloys is determined using an X-ray fluorescence method in which 500 mg of the alloy are irradiated using a tungsten target X-ray tube. The intensity of the Kα line for cadmium corrected for background is compared to corrected intensities measured for solutions of known cadmium content. The method is applicable to the determination of cadmium concentrations of 0.2 to 28% with relative standard deviations in the range from 25 to 0.7%.
Author (NSA)

N66-22131# Mound Lab., Miamisburg, Ohio.
HYDROLYTIC SEPARATIONS OF PROTACTINIUM
H. W. Kirby (1964) 13 p refs Presented at the Colloq. on Phys. Chem. of Protactinium, Paris, 28 Dec. 1964
(Contract AT(30-1)-GEN-53)
(MLM-1233J; CONF-650701-1) CFSTI: HC $1.00/MF $0.50

Milligram amounts of protactinium-231 can be separated from its decay products, actinium-227, thorium-227, and radium-223 by hydrolysis from 1*N* and 6*N* hydrochloric acid. Separation from milligrams of thorium is accomplished by hydrolysis in 1*N* nitric acid and from niobium by hydrolysis in a mixture of oxalic and hydrochloric acids. Iron is separated by selective dissolution of its hydroxide in dilute hydrochloric acid. Micrograms of protactinium are separated from its decay products by adsorption on glass wool from a dilute sulfuric acid solution and by the method of residue adsorption and selective desorption from a gold surface. The application of the adsorption technique to the problem of "inextractable polymers" is discussed briefly. Author (NSA)

N66-22151# Los Alamos Scientific Lab., N. Mex.
HEATS OF DISSOCIATION OF GASEOUS HALIDES
R. C. Feber 24 May 1965 185 p refs
(Contract W-7405-ENG-36)
(LA-3164) CFSTI: HC $5.00/MF $1.00

Heats of dissociation at 298.15°K of the gaseous fluorides, bromides, and iodides of elements of the first long period of the periodic table and beyond are calculated from available experimental data for the heats of formation of the condensed phases and data for vapor pressure and other equilibria. Results derived previously for the chlorides are included and in some cases modified or extended with subsequent data. Estimates are made for many of the halides for which experimental data are lacking. The previous review of heats of atomization of selected elements is extended to include several more elements and more recent vapor pressure data for the remaining elements. Author (NSA)

N66-22183*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE CHEMISTRY AND USE OF CELLULOSE DERIVATIVES FOR THE STUDY OF BIOLOGICAL SYSTEMS
N. Weliky and H. H. Weetall [1965] 57 p refs Submitted for Publication
(Contract NAS7-100)
(NASA-CR-63141) CFSTI: HC $3.00/MF $0.50 CSCL 06A

Cellulose chemistry is surveyed, with emphasis on cellulose as a carrier for proteins, other polymers, and simple organic molecules. Cellulose and cellulose derivatives are discussed as they apply to the preparation of systems useful for biochemical studies. N.E.N.

N66-22184*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MASS SPECTROMETRIC INVESTIGATION OF THE REACTIONS OF O-ATOMS WITH H_2 AND NH_3
E. L. Wong and A. E. Potter 26 Jan. 1965 38 p refs Submitted for Publication
(NASA-TM-X-56452) CFSTI: HC $2.00/MF $0.50 CSCL 07B

The reaction of H_2 with O in the absence of O_2 was studied in the temperature range 400° to 600°K by using a stirred reactor with a mass spectrometer for analysis. The rate constant for the $H_2+O \rightarrow OH+H$ reaction was found to be $4.3\times10^{13}\ e^{-10,200/RT}$ cc/(mole)(sec). The rate of O consumption was bout three to five time smaller in the absence of O_2 than in its presence. This difference was quantitatively explained as a result of the reaction sequence $H + O_2 + M \rightarrow HO_2 + M$; $HO_2 + O \rightarrow OH + O_2$. The reaction of NH_3 with O in the absence of O_2 was also studied for the temperature range 350° to 600° K. The stoichiometry of the reaction could be approximately represented by $NH_3+4.4\ O \rightarrow NO+0.5\ H_2+1.2\ O_2+1.0\ H_2O$. In contrast to the H_2+O reaction, the rates for consumption of O were not affected by the presence or absence of excess O_2 within experimental error. A reaction mechanism was proposed, and using this mechanism the rate constant for the $NH_3+O \rightarrow NH_2+OH$ reaction was estimated to be $1\times10^{12}\ e^{-4,800/RT}$ cc/(mole)(sec). Author

N66-22203*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MINIMIZATION OF ERRORS IN SHOCK TUBE INVESTIGATION OF BROMINE DISSOCIATION RATES IN PRESENCE OF NOBLE GASES
Marvin Warshay [1965] 14 p refs Submitted for Publication
(NASA-TM-X-56448) CFSTI: HC $1.00/MF $0.50 CSCL 07D

A shock tube with a glass driven section was employed to obtain reliable dissociation rates of bromine in dilute mixtures (1%) with various noble gases (Ar, Ne, and Kr) at temperatures of 1200° to 1900°K. Using dilute bromine mixtures and successfully avoiding bromine–metal contact eliminated two serious problems, namely, large temperature changes during dissociation and bromine–metal reactions. The driven section and gas mixture bottles were made of glass and were strengthened (as much as tenfold) by external fiber glass bonding; all valves, lines, and a novel shock-tube transition section were made of TFE fluorinated polymer. Bromine concentrations were measured by a light absorption technique in which highly stable power supplies and incandescent light sources (<0.05 percent change/hr) were employed. The photomultiplier system developed for this work produced low fatigue rates (0.1 percent/msec), high signal-to-noise ratios (100), and rapid response (0.7 μsec). Author

N66-22253*# California Univ., Berkeley. Space Sciences Lab.
CONVENIENT LABELLING TECHNIQUE FOR MASS SPECTROMETRY: ACID CATALYZED DEUTERIUM AND OXYGEN-18 EXCHANGE VIA GAS-LIQUID CHROMATOGRAPHY
Wilhelm J. Richter, Martin Senn, and A. L. Burlingame [1965] 5 p refs Submitted for Publication
(Grants NsG-101-61; NsG-243-62) CFSTI: HC $1.00/MF $0.50 CSCL 06C

Ketone and aldehyde compounds labelled with deuterium were passed through a tandem GLC (gas-liquid chromatographic) column using acidic exchange conditions for studying the exchange of enolizable hydrogen for deuterium. The collected sample of each compound after a single passage through the column was analyzed mass spectrometrically and the results show that the keto esters and aldehydes were labelled satisfactorily. In addition, the acid medium used allowed the method to be extended to oxygen-18 labelling; and these results are compared with the deuterium labelling. The results indicate the ease and rapidity with which exchange of enolizable hydrogens and carbonyl oxygens can be quantitatively achieved through use of the column. The method is well suited for the high quality preparation of pure labelled compounds of synthetic and natural products available in only minute amounts. L.S.

N66-22303*# National Aeronautics and Space Administration, Washington, D. C.
MASS SPECTROMETRY OF GASEOUS MIXTURES IN MAGS-2 APPARATUS [MASS-SPEKTRAL'NYY ANALIZ GAZOVYKH SMESEY NA PRIBORE TIPA MAGS-2]

Ya. A. Yukhvidin Feb. 1966 21 p refs Transl. into ENGLISH from Zavodsk. Lab. (Moscow), v. 23, no. 1, 1957 p 35–41
(NASA-TT-F-1005) CFSTI: HC $1.00/MF $0.50 CSCL 07A

The Soviet lag in mass spectral gas analysis is due to lack of equipment. Uses and limitations of the MS-1, MS-2, MS-2M, MS-3 and MS-4 are discussed, leading to extensive evaluation of a new gas analyzer, the MAGS-2. Text and figures give detailed description of instrument. Author

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N66-21120# Washington Univ., Seattle. Dept. of Electrical Engineering.
UNEQUALLY SPACED ARRAYS FED FROM TRAVELING WAVE SOURCES
J. N. Lahti and Akira Ishimaru Sep. 1965 40 p refs *Its* Tech. Rept.-75
(Contract AF 19(628)-2763)
(AFCRL-65-721; AD-627525) CFSTI: HC $2.00/MF $0.50

The paper deals with the problems encountered when one wishes to synthesize a specified radiation pattern with a unequally spaced array which utilizes a traveling wave feed system. A differential equation is developed which relates the amplitude distribution to the source position function of such an array. Solutions of this equation are found which allow the synthesis of a broad class of radiation fields. The theory is used to design a traveling wave fed unequally spaced array to produce the cosecant squared pattern. Theoretical and experimental results are observed to be in good agreement. Author (TAB)

N66-21123# Technical Operations Research, Burlington, Mass.
METEOROLOGICAL EFFECTS ON RANGE RATE ERRORS OF RADIO INTERFEROMETER TRACKING SYSTEMS: CAPE KENNEDY Final Report, 1 Aug. 1962–30 Sep. 1965
W. W. Vickers, C. G. Fain, J. H. Meyer, and R. Griffith Oct. 1965 129 p refs
(Contracts AF 19(628)-2912; AF 19(604)-6661)
(TO-B-65-104; AFCRL-65-819; AD-627615) CFSTI: HC $4.00/MF $1.00

During past Mercury-Atlas shots from Cape Kennedy varying degrees of difficulty with noise were encountered in the General Electric, Mod III microwave interferometer tracking system. This noise was allegedly caused by variations in atmospheric structure and composition. Stratification of moist and dry layers and intrusions of moist air into dry air (upward penetration of cumulus clouds into dry air) apparently produced sufficient variation of medium to cause fluctuations in the interferometer tracking trace. The primary purpose of this study, therefore, has been to investigate the effects of atmospheric refraction anomalies on radio interferometer tracking systems and, ultimately, to be able to predict the relative magnitude of tracking errors resulting from atmospheric conditions. Author (TAB)

N66-21124# Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
CW-DETECTION TECHNIQUES
Edward R. Meyer and Jean F. Bodine 19 Nov. 1965 59 p refs
(Contract DA-28-043-AMC-00379(E))
(EDL-M794; AD-626592) CFSTI: HC $3.00/MF $0.75

Three techniques were investigated as possible schemes for improving the detectability of a Continuous-Wave (CW) signal within a large Radio-Frequency (RF) bandwidth when a minimum of detection time is available. Each technique is compared to a conventional sweeping receiver. Two of the techniques employ post-detection integration as a means of obtaining sensitivity without imposing undue sweeping accuracy and stability that is required for predetection integration techniques. While post-detection integration is less efficient in terms of sensitivity-search rate capability, it is less complex to implement that predetection techniques. These techniques are based on the premise that by using basically less complex equipment operating in parallel channels, a system could be built that had comparable capability at a lower cost. It would also have greater reliability, even though a greater mass of equipment would be required. The other technique investigated employs a phase-coherent multiple-frequency local oscillator (LO), or picket fence, as a means of providing multiple-signal outputs that are summed coherently before detection, whereas noise outputs are summed incoherently as an attempt to improve signal detectability. Author (TAB)

N66-21157# Federal Aviation Agency, Atlantic City, N. J. Test and Evaluation Agency.
FEASIBILITY TEST OF SEARCH AND RESCUE RADIO BEACON Final Report
John H. Torbert and Francis W. Jefferson Dec. 1965 30 p
(RD-65-136)

This report contains the results of technical tests performed on a feasibility model of a dual-frequency VHF/UHF Search and Rescue Radio Beacon (SRRB). The SRRB was tested at facilities and at sea to investigate equipment performance and to evaluate two types of carrier modulation (constant and swept-tone). Results of the tests indicated that the concept of a dual-frequency SRRB is feasible for search and rescue operations, that its use would increase the number of search aircraft now available to include all operational military aircraft, and that the swept-tone modulation is most desirable for this application. Recommendations are made for adoption of the swept-tone modulation for emergency use and consideration. Author

N66-21159# Federal Aviation Agency, Kansas City, Mo. Systems Maintenance Div.
EVALUATION OF AN ILS GLIDE SLOPE MONITOR TECHNIQUE USING A MONITOR DETECTOR WITH TWO ANTENNAS Interim Report, Apr. 1963–May 1964
William Mumper Dec. 1965 43 p
(RD-65-102)

This report concerns the installation and evaluation of a newly developed clearance monitor system for the standard ILS null-reference glide slope. It is designed to provide an indication of the glide slope path width that is independent of snow cover conditions or changes in path angle. With minor exceptions, the test monitor system performed in the manner predicted. These exceptions relate principally to the detector point location in the near field, but do not derogate the system's application. This report finds that the

proposed monitor system is superior to the present monitor system. It finds the principal disadvantages are the additional height required for the monitor antenna support and the cost of the additional components required. Author

N66-21170# Sylvania Electric Products, Inc., Waltham, Mass. Applied Research Lab.
PLASMA-COVERED SLOT ANTENNAS Final Report, 1 Nov. 1962–30 Sep. 1965
Janis Galejs, Michael Mentzoni and S. Seshadri Oct. 1965 62 p refs
(Contract AF 19(628)-2410)
(F-3040-1; AFCRL-65-859; AD-626902) CFSTI: HC $3.00/MF $0.75

Theoretical studies have led to several formulations of antenna impedances in a plasma environment, the accuracy of which have been verified experimentally. Analytical work is also reported on finite temperature effects on plasma-covered antennas and on antennas in a generally stratified dielectric. An initial study on nonlinear and breakdown effects of signals has been reported. The results of microwave diagnostic studies of electron removal and energy relaxation rates in atmospheric gases are also summarized. Author (TAB)

N66-21179# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
SURVEY OF LITERATURE ON ELECTROTECHNOLOGY [LITERATUUROVERZICHT ELECTROTECHNIEK]
21 Feb. 1966 35 p refs In ENGLISH, DUTCH, FRENCH, and GERMAN *Its* Vol. 15, No. E-481
CFSTI: HC $2.00/MF $0.50

Contains abstracts and bibliographic notes on telecommunications, electronics and microwave techniques, radar, electromagnetic radiation, geometry, information processing, computers (hardware and software), computer applications, measurement and control techniques, miniaturization, inference and reliability, oscillators and magnifiers, components and materials, energy techniques, and technical news. Transl. by J.O.

N66-21191# RAND Corp., Santa Monica, Calif.
DETECTION OF SONAR SINUSOIDS OF UNKNOWN FREQUENCY AND KNOWN OR UNKNOWN PHASE
F. S. Hill, Jr. Dec. 1965 75 p refs
(Contract SD-79; ARPA Order 189-61)
(RM-4809-ARPA; AD-627645) CFSTI: HC $3.00/MF $0.75

The problem of detecting a constant sine wave of unknown frequency and amplitude in gaussian noise is discussed. It is assumed that the sinusoid may appear at any one of a finite number of known frequencies, and the probability of its occurrence at each of these frequencies is assumed to be equal. Two cases are treated. The first assumes that the frequency is not known and the phase of the signal is known, allowing coherent detection. The second acknowledges that the initial phase indeed could not be known, and an analysis of the incoherent detector is made. For large output signal-to-noise ratios the problem in both cases becomes that of detecting one of m approximately orthogonal signals in a noise background. The magnitude of the error in the orthogonality approximation is considered. A physical realization of an approximately optimum detector structure is studied in some detail, and the effect of finite observation time is considered. The results indicate that the difference between the two cases is small and quite predictable. It can be assumed that the initial phase is known, the gaussian character of the quantities that arise may be retained, and finally, the answers can be adjusted to account for the actual lack of knowledge concerning the phase. Author (TAB)

N66-21211# Whittaker Corp., North Hollywood, Calif. Electronics Div.
ATCBI INDICATOR SITE IMPROVEMENTS, MODELS ATCBI-2 AND ATCBI-3 Final Report
Frank V. Hale, Jr. Dec. 1965 130 p
(Contract FA-WA-4706)
(RD-65-132)

A modification program was initiated for the ATCBI Indicator Site equipment in accordance with Federal Aviation Agency Specification FAA-E-2002a. This specification required certain operating characteristics be altered and other operational capabilities be added to both the ATCBI-2 Indicator Site Equipment Group and the ATCBI-3 Indicator Site Equipment Group. This equipment was successfully modified to meet the full requirements of specification FAA-E-2002a, and the end result of this program was modification kits suitable for field installation in the basic equipment. A separate modification kit was produced for installation in the ATCBI-2 Indicator Site Equipment Group and in the ATCBI-3 Indicator Site Equipment Group. The contractor is submitting no additional recommendations as a result of this modification program as both the intent and the detailed requirements of specification FAA-E-2002a have been fulfilled in the design of these modification kits. Author

N66-21235# Joint Publications Research Service, Washington, D. C.
ON THE STABILITY OF ULTRASHORT WAVE SIGNALS ALONG MEDIUM RANGE MOUNTAIN ROUTES
E. V. Zubritskiy, Ye. M. Khomyak, and Ch. Ts. Tsydypov 23 Mar. 1966 17 p refs Transl. into ENGLISH from Elektrosvyaz (Moscow), no. 12, Dec. 1965 p 19–26
(JPRS-34690; TT-66-31129) CFSTI: $1.00

Statistical characteristics of the propagation of ultrasonic wave signals along medium range mountain routes are presented. The measurements, recorded mostly during the summer, were made at frequencies of 100 and 209 megacycles for horizontally polarized waves. The characteristics of the receiving-transmitting instruments are shown. It is concluded that the stability of the signal's level is fairly good, provided the diffraction-mechanism of propagation of the field is predominant on the route (single-peak and comparatively short routes); the signal is subjected to considerable fading, if the diffraction-component of the field is of the same order as the tropospheric component (multi-peak routes). The extent and the frequency of the fluctuations increase with the increase in signal frequency. At mountain routes, no clear relationship is disclosed between the average hourly values of the signal's level and the index of refraction of the air near the surface of the earth, although an explicit correlation is observed between their average daily changes. Slow fluctuations of the field's level can be satisfactorily explained as due to their refraction properties. M.R.W.

N66-21244# Joint Publications Research Service, Washington, D. C.
PECULIARITIES OF SHORT-WAVE COMMUNICATION WITH SPACESHIPS
F. N. Berbasov, T. S. Kerblay, Ye. M. Koval'evskaya, and L. N. Lyakhova 25 Mar. 1966 18 p refs Transl. into ENGLISH from Tr. Vsesoyuznoy Konf. po Fiz. Kojmich. Prostranstva (Moscow), 1965 p 220–227
(JPRS-34723; TT-66-31162) CFSTI: $1.00

The reception of signals on earth from transmitters carried aboard Soviet spaceships is investigated. The study was initiated to analyze peculiarities existing in short wave communication systems between spaceships and ground stations. The statistics cited in this paper apply to cases when the

spaceships were situated below the maximum of ionization of the F2 region outside the zone of direct visibility, and with the transmitters operating at a frequency of about 20 Mc/sec. In order to determine possible propagation paths for signal propagation between a spaceship and the earth, an analysis of the discrepancies between the computed maximum usable frequency (MUF) values and the actual radio communication frequencies (Δf) was conducted; this revealed that their value is essentially dependent on the time of day. It is concluded that when a spaceship is situated below the maximum of the F2 layer, in addition to radio waves reflecting from the F2 layer, waves of a higher frequency can be propagated by the usual way along other propagation paths, and that sporadic ionization in the E layer plays an important role in the propagation of frequencies exceeding standard MUF. M.R.W.

N66-21267# Northeastern Univ., Boston, Mass. Electronics Research Lab.
EVALUATION STUDIES OF TELEMETRY SYSTEM COMPONENTS Scientific Report, 1 Aug. 1964–31 Mar. 1965
Ronald A. Wagner 31 Aug. 1965 291 p refs
(Contract AF 19(628)-2433)
(SR-2; AD-62903) CFSTI: HC $6.00/MF $1.25

The report contains the results of a program for the evaluation of commercial airborne telemetry system equipment. A number of voltage-controlled subcarrier oscillators and VHF transmitters were tested. Test procedures and results are given for all equipment evaluated. Author (TAB)

N66-21318# Hawaii Univ., Honolulu. Dept. of Electrical Engineering.
RELIABILITY BOUNDS FOR POLYPHASE CODES FOR THE GAUSSIAN CHANNEL Scientific Report No. 3
W. Wesley Peterson and Tadao Kasami 25 Jul. 1965 44 p refs
(Contract AF 19(628)-4379)
(AFCRL-65-570; AD-626732) CFSTI: HC $2.00/MF $0.50

Upper and lower bounds on reliability, similar to those given by Shannon (B.S.T.J. 38, 1959, pp. 611–656) are derived and computed for several classes of codes for the gaussian channel which are more restrictive than the classes considered by Shannon. Curves, which include Shannon's results for comparison, are given for selected values of signal-to-noise power ratio ranging from zero to 256. The classes of codes include: (1) codes in which all coordinates of each code vector are either $\pm P$, where P is the signal power, (2) codes in which successive pairs of coordinates in each code vector are chosen as coordinates of q equally spaced points on a circle, and (3) codes in which successive sets of m coordinates of each code vector are chosen arbitrarily from an m-dimensional sphere. Author (TAB)

N66-21323# Syracuse Univ., N. Y. Dept. of Electrical Engineering.
INPUT VSWR MINIMIZATION FOR A TRANSMISSION LINE WITH MULTIPLE DISCONTINUITIES
James G. Rudolph and David K. Cheng Griffiss AFB, N. Y., RADC, Dec. 1965 31 p
(Contract AF 30(602)-2648)
(EE957-6504T11; RADC-TR-65-171; AD-626327) CFSTI: HC $2.00/MF $0.50

A technique using an isometric-circle interpretation of a bilinear transformation has been developed for minimizing the input VSWR of a transmission line consisting of multiple discontinuities joined by line sections. It makes possible the determination not only of the minimum attainable input VSWR but also of the required line lengths between the successive discontinuities. The case for N real and equal discontinuities is particularly simple, and the necessary conditions for obtaining a perfect match are established. Numerical examples are given. Author (TAB)

N66-21338# Army Electronics Labs., Fort Monmouth, N. J.
TRANSMISSION MODE UHF MAGNETO-ACOUSTIC DELAY LINE
William J. Skudera, Jr., Robert Sproat, Isidore Bady, and Emanuel Gikow Dec. 1965 39 p refs
(ECOM-2641; AD-627154) CFSTI: HC $2.00/MF $0.50

Results are presented on the investigation of an experimental magneto-acoustic transmission delay line using a single crystal rod of yttrium iron garnet (YIG), over the frequency range of 200 to 1000 megacycles. Data are given on delay time and insertion loss as a function of magnetic bias field. Both a slow and a fast variation of insertion loss with bias field are noted. The slow variation of insertion loss is quite flat and insertion loss is at a minimum, over the range of 900 to 1050 oersteds, for all frequencies from 200 to 1000 mc. Measurements of VSWR of an untuned line show that the losses due to impedance mismatch account for a relatively small portion of the overall insertion loss. A study of the fast variation of insertion loss shows that this variation occurs only over a portion of the pulse. Therefore, if the pulse is short enough the fast variation is absent. Also small permanent magnets are used to supply a biasing field orthogonal to the primary biasing field that is parallel to the rod axis. The effects of the orthogonal field on the slow and fast variations of insertion loss are described. In addition, two YIG rods were bonded together to provide longer delays than possible with available single rods. Data is presented on the variation of delay time and insertion loss with field of the bonded line. Author (TAB)

N66-21340# Army Electronics Labs., Fort Monmouth, N. J.
RESULTS OF RADIO-PROPAGATION EXPERIMENTS CONDUCTED DURING THE TOTAL SOLAR ECLIPSE OF 20 JULY 1963
Stanley J. Schmidt and Chester E. Sharp Dec. 1965 37 p refs
(ECOM-2644; AD-627161) CFSTI: HC $2.00/MF $0.50

A series of radio wave propagation experiments were conducted during the total solar eclipse of 20 July 1963 to measure its effect on the ionosphere. Receivers monitoring selected optimumly located standard radio broadcast stations and riometers indicating the level of cosmic noise were operated at Copper Center, Alaska, and Jefferson, Maine. A sweep frequency receiver covering the entire standard broadcast band was also operated at the Maine site during the eclipse. Conclusive proof was obtained that the eclipse did affect propagation conditions at the frequencies utilized for standard broadcasting. Out of a total of eighteen broadcast stations monitored, located at intervals between 560 and 1570 kc/s, the increase in the received signal strengths of seventeen stations ranged from 7.5 to 37 dB. All observed signal variations are asymmetrical with respect to the time of on-the-ground totality. There is a threshold phenomenon evident as the increases in signal strength occurred only when the majority of the sun's radiation was cut off. The riometer operated in Alaska indicated a maximum increase of one-half dB in the level of cosmic noise at 30 Mc/s. The change in cosmic-noise level occurred simultaneously with the beginning of the eclipse, increased to a maximum at ionospheric totality, and returned to normal at last contact. Author (TAB)

N66-21351*# Stanford Univ., Calif. Radioscience Lab.
DIGITAL MEASUREMENT OF DIFFERENTIAL TIME DELAY OF PSEUDO RANDOM CODED SIGNALS Scientific Report No. 6
Philip M. Spira Jan. 1966 19 p refs
(Grant NsG-377)
(NASA-CR-71415; SEL-65-027) CFSTI: HC $1.00/MF $0.50 CSCL 09D

In this paper we consider the problem of measuring differential time delay by the use of binary cross correlation of two received signals. Such an operation can be implemented with relative ease compared to analog correlation, especially if processing is to occur on a spacecraft. When both signals are very noisy, it requires approximately 2.46 as much time as analog processing; when one signal is clean, as would be the case in an absolute delay measurement, 2.02 as much time is needed. We assume both signals are corrupted by stationary, white, gaussian noise, bandlimited to the bit frequency of the pseudo-random code. This is done for mathematical simplicity based on digital sampling done once per bit. If the noise bandwidth is larger, and hence independent samples can be made more frequently, no change in any of the results will occur. Author

N66-21354*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
CATALOG OF PRECISELY REDUCED OBSERVATIONS, NO. P-13, 1962 BETA MU 1 (ANNA 1B)
19 Mar. 1965 78 p
(Grant NsG-87-60)
(NASA-CR-71411; SAO Special Rept.-168) CFSTI: HC $3.00/MF $0.75 CSCL 17H

A catalog is presented which includes 1845 observations of Satellite 1962 Beta Mu 1 (ANNA 1B passive) and 902 observations of Satellite 1962 Beta Mu 1 (ANNA 1B flash) obtained from the precise reduction of film taken at 12 Baker-Nunn camera stations. The catalog lists the year, month, and day of the observation; the time of the observation in hours, minutes, and seconds in the smoothed preliminary A.1 system which is defined; the root mean-square (standard error) of the time expressed in milliseconds; the topocentric right ascension expressed in hours, minutes, and seconds of time; the topocentric declination in degrees, minutes, and seconds of arc; the standard error of the position expressed in seconds of arc; the number and name of the Baker-Nunn station; the film and frame number; the measurer's name; and an assigned observation number. R.N.A.

N66-21380# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Electrophysics.
COMPRESSION OF ENGLISH TEXT BY INEXACT TRANSMISSION Interim Technical Report
Beulah Rudner Aug. 1965 23 p refs
(Contract DA-31-124-ARO-D-380)
(PIBMRI-1279-65; AROD-5978-1; AD-626843) CFSTI: HC $1.00/MF $0.50

The subject treated is defined as transmission in which the sense but not the exact symbols of the input message are recoverable. Experimental results in compression by means of minimum redundancy coding are noted, and possible advantages of inexact transmission are discussed. Two forms of inexact transmission were considered in particular: Basic English, and Reduced English. Some statistics on these 2 forms were collected and their word entropies were estimated. Author (TAB)

N66-21385# Philco Corp., Blue Bell, Pa. Advanced Technology Center
ADVANCED ANTENNA TECHNIQUES Final Report, 26 Oct. 1964–26 Oct. 1965
Leo W. Procopio, Thomas K. Kashihara, and Stephen Czorpita Nov. 1965 69 p refs
(Contract AF 19(628)-4769)
(AFCRL-65-907; AD-627376) CFSTI: HC $3.00/MF $0.75

Investigations were conducted to extend the work of past researches in the areas of angular dispersion-compression antennas, super-directive apertures, and multi-dimensional resolution theory. Some new antenna techniques based on the dispersion-compression concept were studied. These antennas, with circular or cylindrical form factors achieve omnidirectional coverage, and multiple beam formation. Preliminary investigations were also conducted to determine the complex illumination functions which can produce pseudo-random antenna patterns having good autocorrelation properties. Author (TAB)

N66-21389# Air Force Cambridge Research Labs., Bedford, Mass.
PURALITY-COUNT DIVERSITY COMBINING FOR FADING M-ARY TRANSMISSIONS
John N. Pierce Nov. 1965 33 p refs
(AFCRL-65-812; AD-627001) CFSTI: HC $2.00/MF $0.50

The performance of a plurality-count diversity combiner for fading M-ary transmissions is analyzed, and calculated error probabilities are presented graphically for alphabet sizes of 2, 8, and 32. The performance is shown to be within 3 db of that of an optimum square-law combiner for moderate alphabet sizes when there is no restriction on the allowable number of diversity branches. It is shown that a worthwhile saving in transmitter power can be effected by using non-binary alphabets with plurality-count combining for the transmission of binary data. The availability of extra information from the combiner for use with error-correction is discussed. Author (TAB)

N66-21408# McDonnell Aircraft Corp., St. Louis, Mo. Research Div.
RE-ENTRY COMMUNICATIONS STUDIES UTILIZING SEEDING TECHNIQUES Final Report, 21 Mar. 1963–31 Mar. 1965
John H. Mullen, Brooks M. Sharp, and Ralph A. Murphy Oct. 1965 6 p refs
(Contract AF 19(628)-2764)
(B813; AFCRL-TDR-65-816; AD-627796) CFSTI: HC $2.00/MF $0.50

The object of this research was to determine the effects of chemical seedants on the electron concentration of an rf generated air plasma. 'Hot' and 'cold' uncontaminated air plasmas were generated by means of a 25 kW 1 Mc rf generator. A maximum electron density of 2×10^{12} electrons/cc was obtained at a pressure of 0.37 torr and air flow of 7.5×0.00001 lb/sec. Water, 50% solution of water and ethanol, ethanol, and benzene were added in quantites from zero to 12, 6, 10 and 18% respectively by weight. A radial transmission line was used to measure the electron density and collision frequency. For the 'hot' plasma the results showed that a 1% by weight addition of the seedants reduced the electron concentration to approximately 50% of the original concentration and an addition of 6% reduced the concentration to 25% of the original value. No appreciable difference in electron reduction effects was observed for the four seedants on a weight basis. The electron reduction effects of the seedants in the zero to 1% by weight addition range was considerably greater than that predicted by the first law assuming complete dissociation of the seedant. Author (TAB)

N66-21409# Lincoln Lab., Mass. Inst. of Tech., Lexington.
HAYSTACK POINTING SYSTEM: MATHEMATICAL DEVELOPMENT FOR SATELLITES AND BELTS
Arthur A. Mathiasen, ed. 23 Sep. 1965 44 p refs *Its* Tech. Note 1965-49
(Contract AF 19(628)-5167)
(ESD-TDR-65-454; AD-623017) CFSTI: HC $2.00/MF $0.50

Satellites are implicitly completely described by their orbital elements. The conditions for going from the mean orbital elements of a satellite to osculating elements considering perturbations caused by the ellipsoidal earth, and then to celestial coordinates and their rates of change are derived. For belts, it is necessary to fix a point at which it is desired to direct an antenna. This is done by taking the intersection of a right-ascension half-plane, a geodetic longitude half-plane, a declination cone, or a time varying central angle vector with the belt. The equations for determining this point from the mean orbital elements and the intersecting surface or ray are derived. Author

N66-21413# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EQUIPMENT AND METHODS OF MEASUREMENTS DURING TEST OF ROCKETS
A. V. Kantor 14 Oct. 1965 429 p refs Transl. into ENGLISH of a book "Apparatura i Metody Izmereniy pri Ispytaniyakh Raket" Moscow, Gos. Nauchno-Tekhn. Izd. Oborongiz, 1963
(FTD-MT-64-199; AD-623137) CFSTI: HC $9.01/MF $2.75

In this book are presented methods and system of measurements, applied during stand and flight tests of rockets. In detail are considered telemetering and on-board measurements, external-trajectory measurements, methods of combining telemetering and external-trajectory measurements, system of single time and different aspects of stand measurements. Some light is thrown on 'the measurements themselves' together with 'processing' of obtained results. Along with systems of analog type detailed consideration is given to discrete systems of measurements and to automation in processing the results of the measurements executed during stand and flight tests. Descriptions are given of various types of equipment used for measurements during rocket tests. Author (TAB)

N66-21462# Marchetti (J. W.), Inc., Natick, Mass.
ANTENNA ARRAY ELEMENT STUDY First Quarterly Interim Report
M. B. Haslam and W. A. Murphy Griffiss AFB, N. Y., RADC, Jan. 1966 34 p
(Contract AF 30(602)-3707)
(G-149-QR-1; RADC-TR-65-357; AD-627896) CFSTI: HC $2.00/MF $0.50

An investigation and analytical study of antenna array elements is being carried out to determine the influence of an individual element of specific characteristics on the performance of an array and, on the basis of element performance, present data which would assist the element designer in selecting the optimum element. A comprehensive literature survey will form part of the basis for, and become a supplement to, the analytical study. While the literature survey is to cover and record any type and size of array with any number of elements, the analytical investigation will analyze element behavior and result in a determination of element characteristics in the UHF (400 Mc) through X-Band (10.5 Gc) range of frequencies. Other parameters and limits for the analytical investigation include: (1) Power handling capability (100 watts to 20 kilowatts); (2) Terminal impedance (25 ohms to 1000 ohms); (3) Signal bandwidths (from 10% at UHF to 5% at X-Band); (4) Gain; (5) Polarization; (6) Beamwidth. For the literature search portion of the project, a retrieval file system was designed and the file keysort cards for the system produced; several literature sources and contacts were established; and literature source data has been retrieved and entered on the Keysort cards as the program progressed. Author (TAB)

N66-21495# Illinois Univ., Urbana. Radiolocation Research Lab.
A PROGRAM FOR COMPUTING THE IONOSPHERE TILT ANGLES FROM THE RADIO RAY ARRIVAL ANGLES Technical Note No. 39
David G. Detert and Roger A. Vossler Jan. 1966 28 p refs Sponsored by Army, Navy and AF
(RRL-287; AD-627403) CFSTI: HC $2.00/MF $0.50

From the distance between the transmitting and receiving stations, the height of the radio ray reflection, and the arrival angles of the radio ray at the receiver, this program will determine the attitude of the tilt vector of the ionosphere at the point of reflection of a single-hop propagation path. In addition the perpendicular deviation for the transmitter-receiver great circle bearing to a point directly under the point of the reflection is also computed. In order to establish a suitable model of the problem, it is assumed that: (a) the propagation path is represented by its Martyn equivalent; (b) the ionosphere is a plane mirror at the point of the reflection; (c) the earth is a sphere with a radius of 6371.22 kilometers. This program is coded in FORTRAN. The computer involved in this case is a Control Data Corporation G-20 using the SPACE programming system. Author (TAB)

N66-21520# Federal Electric Corp., Paramus, N. J.
DEVELOPMENT OF A PROCEDURE FOR OBTAINING A PREDICTED MEASUREMENT OF THE ELECTROMAGNETIC ENVIRONMENT AT A SITE Final Engineering Report, 17 Jun. 1964-15 Jun. 1965
15 Jun. 1965 64 p refs
(Contract NObsr-91236)
(AD-627675) CFSTI: HC $3.00/MF $0.75

The objective of the study was to develop a technique for obtaining a predicted measurement of the electromagnetic environment at a site, based on limited measurements taken over a relatively short calendar interval. A literature search was performed to uncover information which would be useful in the development of such a technique. Weather data and signal intensity data on a wide range of frequencies were collected at Lincoln Park, New Jersey, during the interval 7 August 1964 through 11 September 1964 and the interval 12 January 1965 through 5 February 1965. These data, expected to be important in the development of the technique, formed the basis for conducting analyses to develop useful relationships between variations in signal intensity and other parameters, such as, temperature, humidity, refractive index, and time of day. TAB

N66-21532 Office of Naval Research, Washington, D. C.
ULTRA-RELIABLE TRANSCEIVERS
D. G. Brown *Its* Third Conf. on the Navy Microelectron. Program [1965] p 43-48 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

Two studies have been conducted on techniques to provide an order of magnitude improvement in communications equipment reliability. As a result of these studies, two uhf feasibility transceivers were constructed with a design

goal of two years operation with no maintenance at 98% confidence level. Both units are all solid state and utilize microelectronics to the maximum extent feasible. In order to approach the desired reliability, redundant and adaptive circuitry has been used extensively. Author

N66-21547 Honeywell, Inc., Seattle, Wash.
TELEGRAPH TERMINAL AN/UCC-IC(V)
C. Clark Gill *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 182–187 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

A microelectronic version of Telegraph Terminal AN/UCC-1 is under development, which is a multichannel voice-frequency carrier equipment that converts up to 16 teletypewriter circuits to frequency shift tones for transmission over a single link. At the receiving end, the AN/UCC-1 converts tones back into individual teletypewriter-loop outputs. Emphasis was directed toward a substantial increase in performance, reliability, and maintainability, with a reduction in size from that of the earlier transistorized version a secondary goal. The design includes only two basic types of integrated circuits, while retaining conventional semiconductors only where reliability is enhanced by their use. Author

N66-21630 Puerto Rico Univ., Mayaguez.
OBLIQUE H-F PROPAGATION
Braulio Dueno, Alfredo Guimaraes (Press Wireless Uruguay, LTDA), O. G. Villard (Stanford Univ.), Kristen Folkestad (Norweg. Defense Res. Estab.), and David Davidson (Deco Electron, Inc.) *In* AFCRL Geophys. and Space Data Bull., Vol. II, No. 1 [1965] p 79–86 Prepared jointly by Press Wireless Uruguay, LTDA, Stanford Univ., Norweg. Defence Res. Estab., and Deco Electron., Inc. (See N66-21626 11-13) CFSTI: HC $6.00/MF $1.50

Since September 1963, propagation measurements have been made in a transequatorial, almost geomagnetically conjugate path with a great-circle distance of 6025 kilometers from Mayaguez, Puerto Rico to Montevideo, Uruguay; in a south–north path from Mayaguez, Puerto Rico to Maynard, Massachusetts; in a west–east path from Stanford, California to Maynard, Massachusetts; and in an east–west path from Andoya, Norway to Maynard, Massachusetts. A map of these propagation paths is shown. Granger type equipment for oblique–incidence ionospheric sounding are used in all paths and operate over the frequency band from 4 to 64 Mcps. A selected group of 10 ionograms observed at different times within a 7-hour period on 1 March 1964 is shown. Each ionogram is a plot of the relative group–delay time versus the frequency of the signal being propagated. Also shown are mass-point plots of diurnal variation of maximum frequency and minimum frequency for long and short pulses for different paths. R.N.A.

N66-21651*# Kansas Univ., Lawrence. Remote Sensing Lab.
FRESNEL ZONE PROCESSING OF SYNTHETIC APERTURE RADAR DATA
M. D. Buchanan and R. K. Moore 3 Jan. 1966 31 p *Its* Tech Rept.-61-1
(Contract NSR-17-004-003)
(NASA-CR-71405) CFSTI: HC $2.00/MF $0.50 CSCL 17I

Theory of synthetic aperture radar is discussed, method of obtaining and storing data is presented, and Fresnel zone processing of these data is outlined. The required processing unit is described and illustrated, and the associated circuitry required for such a processor is diagrammed. Resolution of the proposed system can be determined by comparing the amplitudes of the resultant signals from two perfect reflectors, one at the point of focus and the other a certain azimuthal distance from focus. Calculation of these amplitudes involves summing the integrals of the real part of each vector on the signal film over all the Fresnel zones. Formulas are included to determine the boundary limits and the amount of phase change in the returned signal from some point of focus. A computer program was constructed to calculate the relationship between minimum resolution, range, and transmitted wavelength. The definition of resolution used has very little effect on the range and wavelength dependence of the system, but it does determine the constant term in the value of azimuthal distance. M.W.R.

N66-21691*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYNCOM ENGINEERING REPORT, VOLUME I
Washington, NASA, Mar. 1966 165 p
(NASA-TR-R-233) CFSTI: HC $2.00/MF $1.00 CSCL 17B

This report is first of a planned series of reports on the Syncom satellite system. It is an engineering report covering the satellite, the communications ground stations and the telemetry and control ground stations. This report covers a description of each of the Syncom satellite system subsystems in addition to their operation and performance. The time period covered by this report is from launch through the first one hundred fifty days in orbit. Author

N66-21734# Weapons Research Establishment, Salisbury (Australia).
THE APPLICATION OF FOURIER SERIES TO THE SMOOTHING OF DATA
H. H. Evans Jan. 1966 33 p refs
(WRE-TN-SAD-156) CFSTI: HC $2.00/MF $0.50

Two methods of large-scale data smoothing based on the use of Fourier series are discussed together with estimates of their noise attenuation properties. The first method, due to Lanczos, is applicable to data contaminated by uncorrelated noise, and consists of fitting a sine series to the data. In order to increase the rate of convergence of the Fourier fit to the, assumed, continuous signal the data is slightly modified before the actual smoothing process is applied. The second method, which is not subject to the uncorrelated noise restriction, is based on the cross-correlation technique of signal detection; the raw data being cross-correlated with a suitable artificial series. A significant difference between the two methods is that whereas the cross-correlation method yields the smoothed signal directly and for some applications may be superior from the computational point of view, the Lanczos method involves reconstructing the smoothed signal from an assemblage of harmonic terms. Author

N66-21735# Joint Publications Research Service, Washington, D. C.
RADIO WAVE PROPAGATION
M. P. Dolukhanov 28 Mar. 1966 33 p refs Transl. into English from the Monograph "Radio 70 Let" Moscow, Izd. "Svyaz", 1965 p 169–189
(JPRS-34766; TT-66-31205) CFSTI: $2.00

Radio wave propagation aspects were studied for (1) exploitation of new radio wave ranges at higher and at lower frequencies; (2) application of probabilistic and statistical methods to radio wave propagation; (3) closer correlation between propagation processes and undistorted transmission of information through communication channels; and (4) transmitting of information over great distances by space radio communication systems. G.G.

N66-21736# Joint Publications Research Service, Washington, D. C.

ANALYSIS OF THE NOISE-STABILITY OF CODES WITH SUMMATION IN COMMUNICATIONS SYSTEMS WITH REPETITION

M. A. Bykhovskiy 6 Apr. 1966 17 p refs Transl. into ENGLISH from Elektrovyaz (Moscow), no. 1, Jan. 1966 p 60–65

(JPRS-34914; TT-66-31352) CFSTI: $1.00

Considered are summation codes that uncover all single-polar errors in the code combination through repetition. These codes are constructed by assigning the first m positions of the n- valued combinations to information transmission, and by using the remaining k=n−m positions for checking and transmitting of binary numbers equal to the quantity of those transmitted in m- informational positions. Simple formulas expressing the noise-stability of the codes are developed, and a comparison of summation codes and constant weight codes in communications systems with repetition is given. G.G.

N66-21759# California Univ., Berkeley. Electronics Research Lab.

H-GUIDE LOG-PERIODIC SLOT ANTENNA

George N. Voronoff 6 Dec. 1965 136 p refs

(Grant AF-AFOSR-139-65)

(ERL-65-34; AD-627417) CFSTI: HC $4.00/MF $1.00

A theoretical and experimental investigation of an end-fire (as contrasted to a conventional back-fire design) flush-mounted log-periodic slot antenna is described. The antenna consists of two-periodic slot arrays cut in one of the metal walls of a tapered H-guide. The antenna receives excitation at the large end of the structure and radiates toward the small end, yet retaining pattern integrity over large bandwidth. This is made possible by judiciously employing the surface wave properties of a broadband TE_{01} mode propagated in a tapered H-guide. It has been shown theoretically that the energy can be transported from the large end of the structure to a desired active region located near the small end, without appreciably exciting the preceding portions of the antenna. The results of the near field measurements, antenna VSWR, and radiation patterns are presented. The antenna radiates essentially constant patterns over a 3:1 bandwidth with half-power beamwidths of approximately 20° in the E- and H-planes. The results of this study indicate that the antenna can generate a narrow beam and is potentially capable of transmitting high power. Author (TAB)

N66-21819*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

PCM TELEMETRY DATA COMPRESSION STUDY, PHASE 1 Final Report, 15 Sep. 1964–15 Aug. 1965

W. R. Bechtold, J. E. Medlin, and D. R. Weber Oct. 1965 440 p refs

(Contract NAS5-9729)

(NASA-CR-71528; M-62-65-2) CFSTI: HC $4.39/MF $2.25 CSCL 09F

A study was made, using S-6 (Explorer XVII) satellite PCM data, to evaluate methods by which data compression can be achieved. After making an initial literature search and a compression model selection, emphasis was placed on compression model simulation analysis and an adaptive buffer queuing control study. The S-6 data waveforms used in the simulation were selected to match particular data classes. The results of these studies showed that a particular type of first-order polynomial interpolator achieved the highest performance in reducing the bandwidth of the telemetry data. Another part of the simulation analysis investigated the effects of precompression filtering and adaptive techniques on compression efficiency, and on reconstructed data fidelity. In the control study simulation tests were performed to determine the type of queuing control that would be needed to curtail or eliminate data loss from buffer overflow in an S-6 satellite telemetry data compressor. The most important result of this study was that adaptive queuing control would not be required as long as the buffer readout rate exceeded the average readin rate by a factor of at least 1/0.98. C.T.C.

N66-21823*# RAND Corp., Santa Monica, Calif.

EARTH COVERAGE PATTERNS WITH HIGH-GAIN ANTENNAS ON STATIONARY SATELLITES

W. Sollfrey Feb. 1966 40 p

(Contract NASr-21)

(NASA-CR-71551; RM-4894-NASA) CFSTI: HC $2.00/MF $0.50 CSCL 09F

This memorandum presents coverage patterns which may be attained by the use of highly directive antennas on stationary communications satellites. The equations for the intersection of a sphere and a conical beam aimed at an arbitrary point on the sphere are set up and solved. The results are presented in graphic form. Coverage patterns are plotted on Mercator charts for antennas of 2° to 10° beamwidth aimed at points on the earth's surface offset from the subsatellite point by 0, 30, 45, and 60 great-circle degrees at various antenna azimuths. An overlay Mercator map of the earth is provided, which permits the user to find the effect of placing the satellite at different longitudes along the equator. As a typical result of the use of these curves, it has been found that the North Atlantic region can be covered from a satellite with a 7° antenna beamwidth at 58°W longitude looking at a point offset 45° with an azimuth of 75° north of east. The entire region visible to a synchronous satellite may be covered by a 17° beamwidth. Thus, a 7.7-db increase in antenna gain is available. The curves and overlay map permit the reader to find other possibilities. Author

N66-21844# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

TRANSIT ORBIT IMPROVEMENT PROGRAM, VOLUME I

Mar. 1961 509 p refs

(Contract NOrd-7386)

(TG-401, Vol. 1; AD-627364) CFSTI: HC $7.95/MF $2.25

The book is arranged to provide first a pedagogical description of doppler tracking, by way of introduction, followed by theoretical background information, supporting papers, an operations manual for orbit improvement program, and descriptions of the programs themselves. References are included throughout and at the end of most of the articles. Many of the referenced papers are included as part of the book. All the papers originally appeared as internal memorandums of the Laboratory and have been retained in this format in the interests of expediting publication. All the papers can be read independently and are paginated separately. TAB

N66-21845# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

TRANSIT ORBIT IMPROVEMENT PROGRAM, VOLUME II

Mar. 1961 367 p refs

(Contract NOrd-7386)

(TG-401, Vol. II; AD-627365) CFSTI: HC $7.00/MF $1.75

This manual describes procedures for operating the Transit Orbit Improvement Program on the IBM 709 and 7090 Data Processing Systems. Input and output are stressed; the programs are treated essentially as 'black boxes'. To describe

input–output, liberal use is made of sample card listings. A typical set of data from Transit 2A is presented together with output listings from a normal run. To describe operations, a comprehensive 'countdown' chart is presented followed by a troubleshooting section based on experience to date. Since the programs are of an experimental nature they contain many diagnostic features not used in daily orbit improvement; reference to them is omitted here but may be found in the program listings. Finally, various presets in the program have been adjusted empirically to the data processed from the satellites 1960 Gamma 2 and 1960 Eta 2 (Transit 1B and 2A). Should the user wish to use these programs for processing data of different characteristics, he is likely to find the necessity for changing preset values and operating procedures. TAB

N66-21853# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MANUAL OF SHIPBORNE MEDIA FOR RADIO NAVIGATION AND COMMUNICATION (EXTRACTS OF TECHNICAL DATA)
23 Jul. 1965 32 p Transl. into ENGLISH from the Publ. "Spravochnik po Sudovym Sredstvam Elektroradionavigatsii i Svyazi (Izdaniye Vtoroye. Pererabotannoye i Dopolnennoye)" USSR, Izd-vo "Morskoy Transport", 1960 49 p
(FTD-TT-65-829/1+4; AD-619489) CFSTI: HC $2.00/MF $0.50

Extracts of technical data on shipboard radar systems, radio transmitters, receivers, direction finders, gyrocompasses, sonar devices, auto rudders, transceivers, auto-alarms, and distress transmitters for radio navigation and communication are presented. The data includes such information as wave length, pulse power, duration of pulses, pulse repitition frequency, sensitivity of receiving device, width of antenna radiation pattern in horizontal plane, operational range scales, intermediate frequency of receiving device, and accuracy in determining direction. M.R.W.

N66-21875# Lenkurt Electric Co., Inc., San Carlos, Calif.
AMPLIFIER ASSEMBLY AM-4006( )/FCC-17 (SUPERGROUP CARRIER AMPLIFIER), PHASE A Technical Report
D. D. Whipple and J. Sepe 21 Jan. 1966 31 p refs
(Contract AF 30(635)-11188)
(RADC-TDR-63-507, Vol. I; AD-628157) CFSTI: HC $3.60/MF $0.50

This report contains a summary of the design and development problems and a detailed theoretical discussion of the Supergroup Carrier Amplifier. The Supergroup Carrier Amplifier was designed and developed to increase the load capability of up to six supergroup carrier frequencies, supply each of the six supergroup carrier frequencies to two supergroup modulators or, by proper strapping, supply each of two supergroup carrier frequencies to six supergroup modulators. The predicted Mean-time-Between-Failure of the Supergroup Carrier Amplifier is 3330 hours with an estimated Point Availability of 99.992 percent. Author (TAB)

N66-21922# New York Univ., N. Y. Lab. for Electroscience Research.
CORRELATION PROPERTIES OF MULTI-LEVEL CYCLIC SEQUENCES, PART II Final Report, Sep. 1, 1964–Aug. 31, 1965
Karl N. Levitt Nov. 1965 179 p refs *Its* Tech. Rept.-400-125
(Contract DA-31-124-ARO-D-253)
(AROD-4949-3; AD-627240) CFSTI: HC $5.00/MF $1.00

The report considers the problem of synthesizing cyclic (or periodic) sequences, with binary and nonbinary (N-ary) symbols, for special communication applications. The first part of the report is concerned with the derivation of new classes of sequences. New theoretical developments are presented on the cyclic correlation properties of sequences contining the N (th) complex roots of unity as symbols. The second part is concerned with the application of the sequences derived, as well as other known classes of sequences, to two special communication problems. The first application is a binary asynchronous linear multiplex system. There are k transmitter-receiver pairs, each using sequences (which are summed linearly) as carriers for binary information. Although a particular transmitter is synchronized with the corresponding receiver, the other transmitter-receiver pairs are asynchronous with this pair. The second application is an N-ary synchronous 'hard-limiting' multiplex system. For this application there are also k transmitter-receiver pairs, although the respective carrier sequences are not summed linearly, but 'hard-limited' prior to transmission. TAB

N66-22009# New Mexico State Univ., University Park.
ELECTROMAGNETIC WAVE PROPAGATION IN MEDIA OF PERIODICALLY TIME-VARYING PERMITTIVITY
Dieter Ernst Holberg Albuquerque, N. Mex., Sandia Corp., Jan. 1965 152 p refs
(Contract AT(29-1)-789)
(SC-R-65-889) CFSTI: HC $5.00/MF $1.00

The propagation of electromagnetic plane waves in a nonconducting, charge-free medium having a periodically time-varying permittivity given by $\epsilon(t)=\epsilon/(1-A\cos Bt)$, where A and B are constants, is studied. The wave equations for the electric displacement can be separated into Mathieu's equation for the time dependence and Helmholtz' equation for the space dependence of the field. The properties and computational techniques of Mathieu functions are reviewed. It is found that the propagated waves may vary periodically or exponentially in time. A separate, independent approach to the problem is carried by use of partial difference equations. NSA

N66-22219*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GROUND TRACKING OF THE APOLLO
Friedrich O. Vonbun [1965] 43 p refs Submitted for Publication
(NASA-TM-X-56661) CFSTI: HC $2.00/MF $0.50 CSCL 17I

Details of the global complex of tracking and communications stations, which include a network of ground stations, ships, and aircraft called the Manned Space Flight Network (MSFN) are described and discussed. The purpose of the network is to keep track of the Apollo spacecraft during its entire lunar mission except for those portions of the flight where the spacecraft is occulted by the moon. The major tracking and communications function of the network for each of the major phases of the mission is given; and a table listing each station, the type of tracking system, communications, status, and operational date is presented. Another table listing the functions and characteristics for the Apollo–Saturn V tracking and telemetry systems is also presented. Also given are several graphs indicating velocity errors for spacecraft at various phases of the mission (ascent, transfer trajectory, during lunar orbit, return trajectory, and reentry trajectory). L.S.

N66-22262*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISON OF PHASE-COHERENT AND NON-PHASE-COHERENT CODED COMMUNICATIONS
James P. Strong III and Thomas V. Saliga [1965] 40 p refs Presented at the 10th Ann. Intern. Space Electron. Symp., Miami Beach, Fla., 2–4 Nov., 1965
(NASA-TM-X-56541) CFSTI: HC $2.00/MF $0.50 CSCL 09D

The theoretical word error probability versus signal-to-noise ratio has been evaluated for the following five communications systems: (1) Uncoded, bi-orthogonal, phase coherent; (2) Bi-orthogonal, phase-coherent, word coded; (3) Orthogonal, phase-coherent, word coded; (4) Orthogonal, non-phase coherent, word coded; and (5) Same as (4) but with non-optimum detection. The performances of the coded systems are compared to each other and to the uncoded system. It is shown that systems (2), (3), and (4) are nearly equal in performance for large numbers of bits per codeword and all offer significant signal-to-noise gains over the uncoded system. If n is the number of information bits per word, then the precision of word synchronization relative to system (4) increases: (a) linearly with respect to n for the uncoded system, and (b) exponentially with respect to n for the phase-coherent coded systems. Author

N66-22325 Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany).
THE ROLE OF TELEMETRY IN MODERN IN-FLIGHT MEASURING TECHNIQUES
A. Becker *In* AGARD Selected In-Flight Instrumentation Papers from AGARD Flight Mech. Panel, 26th Meeting Jun. 1965 p 43–62 (See N66-22322 11-14) CFSTI: HC $3.00/MF $0.75

Telemetry standards are discussed briefly. Some common relations between the measuring problem and the measuring system are shown. By means of the results of a telemetry user survey, the properties of some known telemetry systems and subsystems are discussed. Optimized multiplexing methods with variable word length are required for a universal future system. Sometimes, data compression techniques, data selection and data preparation must be applied in order to reduce the information flow. The advantages and disadvantages of telemetry in comparison with airborne recording techniques are discussed. As shown, telemetry has important advantages and most of the drawbacks may be overcome. The transmitting properties of radio waves near the surface of the earth were calculated for the middle of the telemetry frequency band of 215–260 Mc. The improvement by diversity reception techniques against drop-out effects are discussed. Author

N66-22350*# Radio Corp. of America, Princeton, N. J. Astro-Electronics Div.
COLOR TELEVISION STUDY Final Report, Nov. 1965–Mar. 1966
A. Bedford, J. Bingley, J. Broderick, J. Kara, R. Kell et al 31 Mar. 1966 205 p refs
(Contract NAS9-5342)
(NASA-CR-65318; AED-R-2907) CFSTI: HC $6.00/MF $1.25 CSCL 17B

The optimum means of generating and transmitting real-time color television were investigated with respect to transmission from earth orbit to earth, lunar orbit to earth, and lunar surface to earth. The National Television System Committee color standards were chosen so that the video could be distributed and monitored by standard color television broadcast networks. The missions considered were Gemini-Agena, Apollo Block II, LEM-lunar surface and Apollo applications. A proposed variable line sequential scanning system for televising motion pictures was developed which operates on a 1.25 Mc bandwidth and provides a 7.5 frame per second picture with 320 TV line horizontal and 350 TV line vertical resolution. For high resolution snapshots of objects in motion, the sequential camera would operate with a shutter and at a slow scan rate. When there is no relative motion, high resolution still pictures would be provided by the classical frame sequential, single image tube camera operating at slow scan with a filter wheel. N.E.N.

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N66-21146# Radio Corp. of America, Burlington, Mass. Aerospace Systems Div.
ADAPTION FOR SPACE VEHICLES THROUGH ON-BOARD DIGTAL COMPUTER CONTROL Final Report, Mar. 1963–Mar. 1964
A. S. Buchman, Karl J. Klarman, and C. Fred Matthews Wright-Patterson AFB, Ohio. AF Avionics Lab., Apr. 1964 223 p refs
(Contract AF 04(695)-279)
(AL-TDR-64-62; AD-602608) CFSTI: HC $7.00/MF $1.50

Space mission effectiveness can be increased by providing vehicles with the ability to adapt to equipment failures and to unexpected events. The characteristic of adaptiveness can be incorporated into a vehicle through proper organization of data/command flow combined with preplanning of responses to abnormal situations. The study has verified that these functions can be implemented in an on-board digital computer-controller. Concepts and terminology, system organization, methodology and measures of effectiveness were developed and applied to two model missions. Evaluation of a well defined rendezvous spacecraft clearly indicates that substantial increases in mission success may be obtained through computer controlled adaptation. A second analysis applies the same system organization to a complex manned vehicle of the 1970's in order to define a useful upper limit to control computer requirements. The major conclusion of the study is that the implementation of adaptation is feasible, effective and practical. Author (TAB)

N66-21206# European Atomic Energy Community, Brussels (Belgium).
THE COMPILATION AND PROCESSING OF IBM 1401 PROGRAMS ON IBM 7090. VOLUME I: THE COMPILER LANGUAGE PROGRAMMING MANUAL
A. F. R. Brown 1966 156 p
(EUR-2637.e, Vol I) CFSTI: HC $5.00/MF $1.00

In the field of non-numerical data processing it is often more profitable to use a medium size computer instead of a big one. Compilation, however, may better be done on a bigger machine. The four volumes of this report describe a symbolic programming language, its compiler for the IBM 7090 which produces IBM 1401 object programs, and a simulator permitting the execution of these programs on the IBM 7090. Author

N66-21207# Westinghouse Electric Corp., Baltimore, Md.
ANALOG CODING Final Technical Report, 1 Apr. 1964–Jun. 1965
Alvin E. Fein, Ralph M. Heller, Carl W. Helstrom, R. Gary Marquart, and A. Herbert Trock Griffiss AFB, N. Y., RADC. Dec. 1965 161 p refs
(Contract AF 30(602)-3311)
(RADC-TR-65-311; AD-626388) CFSTI: HC $6.00/MF $1.00

Several techniques for reducing the error in the transmission of continuous information are investigated. In self-contained appendixes, the following topics are studied: Coding Networks, Predictive Coding, Forced Erasure Decoding, Mappings, Channel Characterization and Simulation Techniques, and Code Construction. The minimum mean-square errors in some systems that transmit and process continuous information by solely linear operations are compared with the absolutely minimum mean-square error predicted by information theory. The linear encoding of sampled data is also studied. Several results relating to the erasure reconstruction spectrum of generalized group codes are derived. Both the evaluation difficulties of and the future study directions of Forced–Erasure Decoding are discussed. The performance of certain information sources is calculated. A hybrid system for transmitting sampled data is also studied. Techniques for the digital simulation of stochastic processes are discussed and some investigations are suggested. Generalizations of code construction techniques were also studied. The value of these techniques is in hybrid coding situations. Author (TAB)

N66-21231# European Atomic Energy Community, Brussels (Belgium).
THE COMPILATION AND PROCESSING OF IBM 1401 PROGRAMS ON IBM 7090. VOL. II: THE COMPILER PROGRAM DESCRIPTION
A. F. R. Brown Jan. 1966 145 p
(EUR-2637.e, Vol. II) CFSTI: HC $4.00/MF $1.00

In the field of non-numerical data processing it is often more profitable to use a medium-size computer instead of a big one. Compilation, however, may better be done on a bigger machine. The four volumes of this report describes symbolic programming language, its compiler for the IBM 7090 which produces IBM 1401 object programs, and a simulator permitting the execution of these programs on the IBM 7090. This volume explans the structure of the IBM 7090 compiler program. Comments are given on the flow charts of this program and of some subroutines in the 1401 program package that handle magnetic tape input and output. The flow charts themselves are published in the fourth volume of the report. Author

N66-21232# European Atomic Energy Community, Brussels (Belgium).
THE COMPILATION AND PROCESSING OF IBM 1401 PROGRAMS ON IBM 7090. VOL III: THE SIMULATOR PROGRAM
A. F. R. Brown Jan. 1966 72 p
(EUR-2637.e, Vol. III) CFSTI: HC $3.00/MF $0.75

In the field of non-numerical data processing it is often more profitable to use a medium-size computer instead of a big one. Compilation, however, may better be done on a bigger machine. The four volumes of this report describe a symbolic programming language, its compiler for the IBM 7090 which produces IBM 1401 object programs, and a simulator permitting the execution of these programs on the IBM 7090. Author

N66-21251# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
SURVEY OF LITERATURE ON OPERATIONS RESEARCH
24 Feb. 1966 35 p refs In DUTCH, ENGLISH, and GERMAN
Its Vol. 10, no. R-79
CFSTI: HC $2.00/MF $0.50

This report contains abstracts and bibliographic notes on operational research in the iron and steel industry, queueing, programming, game, and inventory theory, and applications (including management, military, quality control, and medical problem application). Transl. by J.O.

N66-21265# European Atomic Energy Community, Brussels (Belgium).
CALCULATION OF COEFFICIENTS OF RACAH, CLEBSCH-GORDAN AND Z [CALCUL DES COEFFICIENTS DE RACAH, CLEBSCH-GORDAN ET Z]
M. G. Cao Jan. 1966 17 p refs In FRENCH; ENGLISH summary
(EUR-2639.f) CFSTI: HC $1.00/MF $0.50

A Fortran II computer program is described for the calculation of the coefficients of Racah and Clebsch-Gordan, and the calculation of the Z coefficient for angular distribution as a function of the first two. The equations are given, and the instructions are listed for the GORDAN subroutine. Transl. by D.T.

N66-21285# United Kingdom Atomic Energy Authority, Culham (England). Culham Lab.
A COMPUTER PROGRAM FOR FINDING COMPLEX ZEROS OF AN ARBITRARY FUNCTION
B. Mc Namara Sep. 1965 40 p refs
(CLM-R-48) HMSO: 5s

This report describes a computer program which finds complex zeros of arbitrary functions by iteration from some given initial guesses. The basis of the iteration is to approximate the given function by simpler functions whose zeros can be simply calculated. The regions of the complex plane in which the iteration converges to a required zero are greatly extended by several ad hoc procedures developed in a study of helicon wave propagation. The program is constructed in such a way as to allow indefinite extension of the facilities offered without reference to the original programming. The helicon wave problem is used as an illustrative example and simple methods by which more complicated eigenvalue problems can be solved are indicated. Author

N66-21310# Harry Diamond Labs., Washington, D. C.
FORTRAN IV PROGRAM FOR GAS TUBES AND OTHER DIELECTRICS
Edward R. Berman and A. L. Ward 5 Nov. 1965 44 p refs
(TR-1310; AD-626901) CFSTI: HC $2.00/MF $0.50

A FORTRAN IV program describes the behavior of electron and ion currents in a gas discharge tube, including the effects of electronic and ionic space charges, by numerical integration of the relevant nonlinear partial differential equations. Provisions are made to allow valid calculations in the solid state. The program, designed for use on the IBM 7094 Operating System, is a rewriting and expansion of an earlier IBM 704 program formulated by Borsch-Supan and Oser in 1960. Discussion is related primarily to use of the program rather than to the physical or mathematical formulation of the problem or the numerical methods used. Author (TAB)

N66-21329# TRW Systems, Redondo Beach, Calif.
ON LINE COMPUTER SYMBOLIC MANIPULATION Final Report, Aug. 1964–Aug. 1965
Frederick W. Blackwell Griffiss AFB, N. Y., RADC, Jan. 1966 199 p refs
(Contract AF 30(602)-3516)
(RADC-TR-65-376; TRW-5253-6001-RU-000; AD-628135) CFSTI: HC $5.00/MF $1.25

The development is described of an on-line computer system for symbol manipulation in which a user can arbitrarily define symbols and rules for operating with these symbols, and then instruct the computer on-line to selectively apply the rules. At the basis of the system is a small set of elementary symbol manipulation operators which can be programmed on-line to carry out more complex symbolic processes. The application of the system to algebra is presented; the resultant system for algebraic symbol manipulation allows the user to have the computer apply rules of algebra on-line to transform mathematical expressions which he has input in a natural form. Author (TAB)

N66-21384# System Development Corp., Santa Monica, Calif.
FAILURE OF A CONJECTURE ABOUT CONTEXT FREE LANGUAGES Scientific Report No. 4
Joseph Ullian 9 Sep. 1965 12 p refs
(Contract AF 19(628)-5166)
(AFCRL-65-806; TM-738/019/00; AD-624939) CFSTI: HC $1.00/MF $0.50

For a set L of words over an alphabet lacking the letter c, let $N(L)=\{xcy \mid x, y \text{ in } L \wedge x \neq y\}$. Haines has shown that if L is regular, N(L) is context free. The converse has been widely conjectured. If true, it would allegedly support a neat argument to show that English is not context free. The failure of the conjecture is established by showing N(L) context free for the nonregular set $L=\{a^i b^j d^k \mid i \neq j \vee j \neq k\}$. Author

N66-21411# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRONIC MODEL OF SELF-ADAPTIVE AND SELF-TEACHING SYSTEMS
O. A. Charkviani and D. K. Surguladze 22 Sep. 1965 58 p refs Transl. into ENGLISH from Avtomat. i Telemekh. (Moscow), v. 3, 1962 p 3–33
(FTD-TT-65-140/1+2; AD-623207) CFSTI: HC $3.00/MF $0.50

A detailed description is given of a recent version of an analog computer for simulation of self-adaptive and self-teaching systems. TAB

N66-21480# System Development Corp., Santa Monica, Calif.
STACK AUTOMATA AND COMPILING Scientific Report No. 6
Seymour Ginsburg, Sheila A. Greibach (Harvard Univ.), and Michael A. Harrison (California Univ., Berkeley) 17 Nov. 1965 65 p refs
(Contract AF 19(628)-5166)
(TM-738/021/00; AFCRL-65-918; AD-628205) CFSTI: HC $3.00/MF $0.75

Compilation consists of two parts, recognition and translation. A mathematical model is presented which embodies the salient features of many modern compiling techniques. The model, called the stack automaton, has the desirable feature of being deterministic in nature. This deterministic device is generalized to a nondeterministic device (non-deterministic stack automaton) and particular instances of this more general device noted. Sets accepted by nondeterministic stack automata are recursive. Each set accepted by a deterministic linear bounded automaton is accepted by some nonerasing stack automaton. Each context sensitive language is accepted by some (deterministic) stack automaton. Author (TAB)

N66-21540 Bureau of Ships, Washington, D. C.
MICROELECTRONIC APPLICATIONS TO DIGITAL PERIPHERAL EQUIPMENT
H. W. Bacheller *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 99–114 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

Details are presented on the extent to which microelectronics has been incorporated into the design of digital peripheral militarized equipment, which are in various stages of development. Programs are reported on a magnetic tape transport and control unit, two types of mass storage devices, and a paper tape punch and reader. Numerous illustrations show the equipment; and, except for the transport and control unit, no overall reduction in size has as yet been accomplished. Reliability testing results are reported to be encouraging. M.W.R.

N66-21546 Sperry Rand Corp., St. Paul, Minn. UNIVAC Div.
CP-667 LARGE SCALE MICROELECTRONICS COMPUTER
G. P. Anderson, M. L. Granberg, F. E. Mc Leod, and L. R. Wozniczka *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 160–181 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

The CP-667 computer is described and compared to similar, existing equipments. The philosophy underlying basic design decisions is discussed including such items as the means of achieving program compatibility with the CP-642B; the advantages of the physical configuration in a shipboard environment; the advantages of wire-wrap from functional, reliability, and cost aspects; and the relationship of these factors to the microelectronics approach chosen for the CP-667. The multi-chip microelectronic circuits are considered. Failure modes are discussed in detail, with illustrations and examples of each principal mode. Corrective action taken is described. The study program aimed at replacement of multi-chip devices with single chip microelectronic circuits as they become available is described, and results summarized. Reasons behind decisions on circuit configuration and package styles are discussed and failure experience is illustrated with appropriate examples. Author

N66-21601# Atomic Energy Establishment, Winerite (England). General Reactor Physics Div.
THE KDF9 PROGRAMME EDIT1
G. Doherty Jul. 1965 14 p refs
(AEEW-M-604) HMSO: 1s 9d

EDIT1 is a KDF9 Fortran program for producing a nuclear data tape, either in binary records, or on the BCD low density mode satisfying the format requirements of the UKAEA nuclear data library described by Parker. The program operates only on complete files which may be in binary or BCD mode for input, though the single IBM compatible tape unit cannot be used for both input and output in the same job. Programs using the data library on the KDF9 will operate in the binary mode but facilities for reading and writing BCD card image libraries are necessary for compatibility with other computer installations. Author

N66-21839# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
THE SYMBOLIC MANIPULATION OF POISSON SERIES
J. M. A. Danby (Yale Univ. Obs.), Andre Deprit, and A. R. M. Rom Oct. 1965 37 p refs *Its* Mathematical Note No. 432 (DI-82-0481; AD-627306) CFSTI: HC $2.00/MF $0.50

Poisson series of three variables are manageable symbolically through a set of formal subroutines written partially in the IBM 7094 machine language, but to be called in the FORTRAN language for use in FORTRAN programs. An effort has been made to supply those operations which are most required by Celestial Mechanics. The routines are entirely self-contained subroutines and require only standard FORTRAN input-output units 5 and 6; they are designed to avoid waste and overflow of core storage space.

Author (TAB)

N66-21863# European Organization for Nuclear Research, Geneva (Switzerland).
A DATA LINK BETWEEN TWO COMPUTERS
F. Marciano 28 Dec. 1965 31 p refs
(CERN-65-40)

A digital link is described which allows exchange of control and data messages between two computers, the CDC 6600 located in the CERN main computing area, and the SDS 920 located at a distance of up to 1 km in the experimental area. Blocks of data can be transferred over the link at a rate of 24 bits/8 μsec in both directions. This is the first item of a system expandable up to eight data links.

Author

N66-21901# International Business Machines Corp., Yorktown Heights, N. Y. Thomas J. Watson Research Center.
SURVEY OF LIFE SCIENCES COMPUTER PROGRAMS Final Technical Documentary Report, 15 Jul. 1963–14 Jul. 1964
Ibrahim B. Hammidi, Lilliam Dresher, and Carol S. Wade Wright-Patterson AFB, Ohio, AMRL, Nov. 1965 181 p refs
(Contract AF 33(657)-11347)
(AMRL-TR-65-113; AD-627152) CFSTI: HC $5.00/MF $1.00

A need exists for dissemination of information on the uses of computers in the life sciences. This report attempts to provide the information necessary to locate and request programs or program descriptions and listings. Typical applications in the life sciences are described for general programs on information retrieval, cross-tabulation of data, tests of statistical hypotheses, regression analysis, multivariate analysis, time series analysis, analysis of variance and covariance, mathematical diagnosis, linear programming, simulation, numerical techniques, and matrix algebra. In addition to these general purpose programs, many special purpose programs exist which are applicable within the gamut of research problems. Some specific examples are finding interatomic distances and angles, blood volume analysis, cardiac arrythmia analysis, etc. The Key-word-in-Context (KWIC)-Index of life sciences computer programs consisting of (1) the Key-Word Index, (2) Author Index, and (3) Code-Name Index is given in the final section of the report. Author (TAB)

N66-21902# Pennsylvania Univ., Philadelphia.
MATHEMATICAL STUDIES FOR SELF-ORGANIZING SYSTEMS Final Technical Report, Jun. 1964–Jun. 1965
Morris Rubinoff, Amy L. Eliasoff, James Korsh, and Donald Shillady Griffiss AFB, N. Y., RADC, Jan. 1966 153 p refs
(Contract AF 30(602)-3030)
(RADC-TR-65-378; AD-627795) CFSTI: HC $3.00/MF $0.50

A detailed technical progress report is given on applicational studies of mathematical models for self-organizing systems. Two specific models have been under investigation, one concerned with systems of interacting trees and graphs and the other with multi-dimensional arrays of mobile interacting elements in a discrete cellular space. The former is being illustrated by the design of a machine (i.e., a computer program) for the automatic logic design of switching systems through boolean graph self-organization under prescribed minimization and circuit restrictions. The latter is being illustrated by the design of a machine for primitive feature recognition through the clustering, reproduction and differentiation of elements under prescribed rules of motion and bonding.

Author (TAB)

N66-21953# Atomics International, Canoga Park, Calif.
MATEDIR. A CODE TO CALCULATE THE DESIGN POINTS OF A MANNED, DIRECT-RADIATING, THERMOELECTRIC SYSTEM
Elizabeth L. Bramblett 9 Jul. 1965 91 p
(Contract AT(11-1)-GEN-8)
(NAA-SR-MEMO-11514) CFSTI: HC $3.00/MF $0.75

MATEDIR is written in FORTRAN II for use on the IBM 7090/7094 with the FORTRAN II Monitor FIB III. A twelve-parameter survey is conducted, and the minimal weight systems are both tabularized and described in detail. NSA

N66-21966# Los Alamos Scientific Lab., N. Mex.
RECENT DEVELOPMENTS IN COMPUTERS AND THEIR IMPLICATIONS FOR REACTOR CALCULATIONS
W. J. Worlton and E. A. Voorhees [1964] 30 p refs Presented at the Conf. on the Application of Computing Methods to Reactor Probl., Argonne, Ill.
(Contract W-7405-ENG-36)
(LA-DC-7007; CONF-650501-7) CFSTI: HC $2.00/MF $0.50

The capabilities and economics of ultrahigh-speed computers for reactor calculations are analyzed. The requirements imposed on the computer industry by reactor calculations are reviewed. The basic types of calculations involved include: criticality, transport, diffusion, dynamics, kinetics, burnup, physics, cross sections, reactor parameters, shielding, engineering, heat flow, stress analysis, and coolant flow. NSA

N66-21975# Oak Ridge National Lab., Tenn. Physics Div.
FORTRAN PROGRAMS FOR THE CLEBSCH-GORDAN AND RACAH COEFFICIENTS AND THE NINE-j SYMBOL
Taro Tamura Nov. 1965 13 p
(Contract W-7405-ENG-26)
(ORNL-3877) CFSTI: HC $1.00/MF $0.50

FORTRAN programs for the Clebson-Gordan and Racah coefficients and 9-j symbol are presented. They are written in a way rather compact and easy to understand. Optimization of the speed of computation was made in these routines. These routines allow for treating the case in which the arguments of these coefficients are very large, and thus can be used, for example, in the analysis of the nuclear reactions of heavy and high energy projectiles. Author (NSA)

N66-21992# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
ON THE USE OF THE MONTE CARLO METHOD TO SOLVE PROBLEMS OF INTERPOLATION [SULL'USO DEL METODO DI MONTECARLO PER RISOLVERE I PROBLEMI DI INTERPOLAZIONE]

G. Cortellessa and G. Farchi 15 Apr. 1965 33 p refs In ITALIAN; ENGLISH Summary
(ISS-65/10)

A method is proposed to fit experimental data to a theoretical curve with parameters to be determined. The parameters of the fit are extracted at random within intervals wide enough to include the solution. The fit is considered good enough if a choice of parameters satisfies a proper statistical test. A program in FORTRAN IV language is written for the IBM 7040 computer. Author (NSA)

N66-22018# Bettis Atomic Power Lab., Pittsburgh, Pa.
COMPUTER CONTROL AND DATA PROCESSING FOR ISOTOPIC MASS SPECTROMETERS
H. D. Cook, F. B. Barker, and J. E. Hudgens Apr. 1965 13 p refs Presented at 13th Annual Conf. on Mass Spectrometry and Allied Topics, St. Louis, 16–21 May 1965
(Contract AT(11-1)-GEN-14)
(WAPD-T-1770; CONF-650519-7) CFSTI: HC $1.00/MF $0.50

A system is described that provides both flexible instrument control and accurate data evaluation. One of the most valuable characteristics of the system is the immediate display of isotopic abundances obtained at the completion of a scan of the mass spectrum and of the average of all scans at the end of a sample run. It permits the instrument operator to observe trends that might tend to bias results and to determine readily whether sufficient data has been obtained before removing the sample from the mass spectrometer. This advantage has improved reliability of data and reduced the number of reruns necessary because of insufficient data.
Author (NSA)

N66-22037# Sandia Corp., Albuquerque, N. Mex.
PREPARATION AND COMPILATION OF EXPERIMENTAL DATA FOR COMPUTER ANALYSIS
Jack L. Mortley Jun. 1965 6 p Presented at Hydraulics Colloq., Iowa City, Iowa
(Contract AT(29-1)-789)
(SC-DC-65-1482; CONF-650622-1) CFSTI: HC $1.00/MF $0.50

A discussion is given of the techniques and problems encountered in semiautomatic and automatic electronic preparation and compilation of measuring instrument outputs. Criteria are given for deciding whether a situation warrants the use of a data link. Typical specifications are given for each of the three storage media-limited systems: punched paper tape and/or card, incremental digital tape, and high-speed digital tape. NSA

N66-22055# Sandia Corp., Albuquerque, N. Mex.
A GENERIC CLASSIFICATION FOR TEACHING MACHINES
G. J. Simmons Jun. 1965 15 p Presented at 3d Ann. Conf. of Natl. Soc. for Programmed Instruction, Philadelphia
(Contract AT(29-1)-789)
(SC-R-65-923; CONF-650548-1) CFSTI: HC $1.00/MF $0.50

A classification is developed for teaching machines based on the nature of the interaction between the student and the programmed instructional material. This approach makes it possible to functionally classify devices of widely different complexities without being misled by the sophisticated device design (or lack of it). Four basic machine types are identified and discussed: (1) linear, (2) recyclical, (3) medical-cyclical (branching), and (4) adaptive. Author (NSA)

N66-22068# Sandia Corp., Albuquerque, N. Mex.
UPDATING A COMPUTER AIR-CONDITIONING SYSTEM
H. H. Baxter, Jr. Apr. 1965 27 p
(Contract AT(29-1)-789)
(SC-DC-65-1391) CFSTI: HC $2.00/MF $0.50

Problems associated with updating an air conditioning system, originally installed to cool type-type computers, to accommodate solid-state computer facilities are outlined. Problems involved in continuity of computer operation during the air-conditioning changeover are also noted. NSA

N66-22123# Los Alamos Scientific Lab., N. Mex.
ARCHPRO: A COMPUTER PROGRAM FOR THE COMPUTATION OF MOLECULAR WEIGHTS BY THE ARCHIBALD METHOD
G. R. Shepherd, P. N. Dean, and B. J. Noland 8 Jun. 1965 16 p refs
(Contract W-7405-ENG-36)
(LA-3291) CFSTI: HC $1.00/MF $0.50

A computer program (ARCHPRO) has been prepared in FORTRAN for computation of ultracentrifugal data obtained in the determination of molecular weights by the Archibald method. Author (NSA)

N66-22275*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACE-CHARGE-FLOW COMPUTER PROGRAM
Carl D. Bogart and Edward A. Richley Washington, NASA, Apr. 1966 119 p refs
(NASA-TN-D-3394) CFSTI: HC $1.45/MF $0.75 CSCL 09B

A description of a computer program for the solution of two-dimensional and axisymmetric space-charge-flow problems is given. The program is written in FORTRAN IV for an IBM 7094 computer. Primary emphasis is placed on nomenclature, word definitions, and programing procedures. The program overlay chart and subroutine flow diagrams are presented, and example sets of input and output data for a variety of boundary conditions are given and fully explained. The program has been applied extensively for the analysis of various electrostatic-thrustor-design concepts, wherein positive charged-particle flow is conventional. It is equally applicable to other problems, such as electron tube design in which the particles (electrons) have a negative charge. Output data listings include detailed information on potential distributions, particle trajectories, thrust, power and current densities, and other parameters of interest. Author

N66-22364*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTEGRATED TELEMETRY-COMPUTER SYSTEM
Donald E. Jamison Washington, NASA, Apr. 1966 28 p
(NASA-TN-D-3396) CFSTI: HC $2.00/MF $0.50 CSCL 09B

This paper discusses the feasibility of integrating a high speed, general purpose, small scale, digital computer with a pulse frequency modulation signal reduction and conversion system in order to obtain the highest quality of intelligence in a minimum period of time. Author

N66-22378*# Operations Research, Inc., Santa Monica, Calif.
PROPULSION AND SPACE VEHICLE SYSTEMS ANALYSIS PROGRAM TENSOR I, VOLUME I Technical Report No. 341

J. B. King, R. J. Krane, G. L. Ordway, A. Reiff, W. E. Schuman et al 30 Sep. 1965 1165 p refs
(Contract NAS8-5321)
(NASA-CR-71904) CFSTI: HC $14.65/MF $7.00 CSCL 09B

The propulsion and space vehicle systems analysis computer program is described in detail. The program is divided into three blocks, which when integrated, provide a comprehensive capability for space mission analysis. Block I provides the necessary subroutines to generate a nonlinear mathematical model representing the steady state performance of a liquid propellant rocket engine system. Block II simulates the flight of a point mass missile in a three dimensional, earth centered, inertial Cartesian coordinate system. Block III is used to determine three dimensional geocentric launch conditions for direct single maneuver lunar and interplanetary transfers. The documentation of each subroutine consists of a listing of the step by step programmed procedure with brief comments regarding the solution. A nomenclature list which defines and references each variable used in the subroutine and a symbolic listing of the subroutine are also included. H.S.W.

N66-22381# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INSTRUCTION SYSTEM AND PROGRAMMING FOR THE BESM-2
V. L. Bazilevich and L. V. Bazilevich 24 Sep. 1965 416 p refs Transl. into ENGLISH of the book "Sistema Komand i Programmirovaniye dlya BESM-2" Leningrad, Izd. Sudostroyeniye, 1964 342 p
(FTD-TT-65-111/1+2; AD-628507) CFSTI: HC $41.20/MF $2.00

The book presents the fundamentals of practical programming for the most common large domestic electronic computer, the BESM-2. The arrangement of the machine and the method of executing instructions are described to the degree required by the programmer. The number systems employed in programming are given, together with various examples of the employment of instructions and operations in program writing. The procedure used in solving problems on the BESM-2 is indicated. The book may be used as a text in training programmers for the BESM-2, and will prove useful to a wide group of readers interested in electronic computers or working in this field. Author (TAB)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N66-21106# Weston Instruments, Inc., Newark, N. J.
A POROUS SUBSTRATE RESISTOR AIMED AT MINIATURIZATION OF METAL-FILM RESISTORS Interim Development Report (Final Project Summary), 1 Sep.-30 Nov. 1965
T. Matley, P. M. Gross, R. G. Drewes, and R. E. Busch [1965] 43 p
(Contract NObsr-87542)
(IDR-13; AD-626482) CFSTI: HC $2.00/MF $0.50

The new cylindrical substrate was checked for uniformity of weight and weight-to-volume ratio. Reproducibility of metallizing was verified using the atmospheric technique. Fifteen lots of ten units per lot were metallized and variations within each lot and from lot-to-lot were noted. Some of these units were used later for load life and temperature coefficient of resistance testing. Development of the new solder terminal was completed and its quality was compared to the epoxy terminal using especially the 90° ratio test. A method of encapsulation was adopted utilizing a ceramic tube, end caps and an epoxy coating. Author (TAB)

N66-21111# Frequency Electronics, Inc., Astoria, N. Y.
LOW POWER PROPORTIONAL CONTROL CRYSTAL OVENS TYPE M6 AND N13 First Quarterly Report, 1 Jul.-31 Oct. 1965
Martin B. Block, Irwin Math, and John C. Ho Ft. Monmouth, N. J., Army Electron. Command, Oct. 1965 15 p *Its* Rept.-1
(Contract DA 28-043-AMC-01475(E))
(ECOM-01475-1; AD-627271) CFSTI: HC $1.00/MF $0.50

The purpose of this report is to design, construct and evaluate two types of miniature low power ovens for regulating the temperature of quartz crystals. The temperature of the ovens is to be controlled by a proportional sensing system and the crystals are to be accessible. One type of oven, the M6, is to maintain one HC6/u crystal at some preset temperature between 80°C and 90°C to within ± .2°C over an ambient temperature range of −55°C to +75°C. The volume of this oven cannot exceed 3 cubic inches and the maximum average power delivered 400 mw. The N13 oven is to maintain two HC/6u crystals at some preset temperature between 0°C and 5°C to within ±.2°C over an ambient range of −55°C to −15°C. The volume of this oven cannot exceed 5 cubic inches, and the maximum average power delivered, 150 mw. The M6 oven must reach operating temperature in 10 minutes and the N13 oven, within 3 minutes. Both ovens can utilize up to 3 watts for rapid warm-up. Author (TAB)

N66-21143# California Univ., Berkeley. Electronics Research Lab.
STUDY OF CROSSED-FIELD AMPLIFIERS Eighth Quarterly Progress Report, 15 Apr.-15 Jun. 1965
R. A. Rao, T. Van Duzer, and S. P. Yu [1965] 25 p refs
(Contract DA-36-039-AMC-02164(E))
(Rept.-8; AD-626183) CFSTI: HC $1.00/MF $0.50

An electron gun which produces a smooth transition from Kino flow near the drift region was designed using a new method of synthesis. An experimental gun was fabricated and tested. The agreement between theory and experiment was good. Noise-figure expressions were derived for cyclotron and space-charge wave amplifiers. These expressions are to be studied to determine the conditions for minimum noise-figure. A five-wave analysis was used to determine the wave amplitudes and phase factors resulting from the interaction between the circuit wave and the beam space-charge waves. The amplitudes of the significant waves were calculated as a junction of beam position for normal experimental conditions. Calculations show that beam-position fluctuation is the most important factor in the noise-figure. A theoretical analysis of crossed-field guns is being carried out to study the effect of a crossed magnetic field on potential minimum stability. A statistical analysis of the cut-off characteristics of the smooth-bore magnetron was completed. The theoretical results were shown to be in close agreement with existing experimental results. Author (TAB)

N66-21196# Douglas Aircraft Co., Inc., Santa Monica, Calif. Advance Electronics Dept.

GENERAL PROBLEMS ASSOCIATED WITH OPERATION OF ELECTRONIC SYSTEMS IN A SPACE RADIATION ENVIRONMENT

B. J. Donaldson 12 Jul. 1965 19 p Presented at IEEE Ann. Conf. on Nucl. and Space Radiation Effects, Mich. Univ., Ann Arbor, 1965

(Douglas Paper-3606)

Problem areas in space radiation effects on electronics are discussed for formulating the most efficient radiation hardening program. These areas include: (1) definition of the worst-case radiation environment to be encountered as to type and energy spectrum of the bombarding nuclear particles and worst-case time integrated flux; (2) simulation and damage correlation of the actual environment with a test environment; (3) proper use of existing radiation damage information; (4) pinpointing the most radiation sensitive components and/or circuits for a specified system; and (5) application of radiation hardening techniques to insure reliable system operation in the worst-case environment. The use of weakest-link design techniques is advised, since the components in an electronic system will exhibit a very wide range in radiation sensitivity. E.A.O.

N66-21209# General Electric Co., Owensboro, Ky. Tube Dept.

LOW-POWER, X-BAND, PLATE-PULSED OSCILLATOR Final Report, 1 Feb. 1963-30 Jun. 1964

J. M. Connelly and J. R. Peterson [1964] 96 p refs

(Contract DA-36-039-AMC-00132(E))

(Rept.-5; AD-609365) CFSTI: HC $3.00/MF $0.75

A triode/cavity oscillator capable of 50 watts of pulse power output and tunable with one knob tuning over a frequency of 9.2 to 9.6 Gc was designed and 10 of the units were built and evaluated for initial performance. Desirable features of the oscillator are its small size, light weight (approximately 1 oz.), and its low power consumption. The filament power is approximately 1.3 watts and the average plate power is approximately 0.75 watts (e_b=1500 V, i_p= 800 ma, % duty=0.05). Twelve tube designs totaling approximately 215 tubes were made and evaluated during the program. The basic problem encountered was insufficient peak emission (j ~ 40 A/cm^2) in tubes at a reasonable cathode temperature. Triodes of the final design, type Y-1249-N, have adequate emission for initial oscillator performance within specification limits. However, the probability of meeting the 500-hour life before the output drops 3 db is undetermined since the contract time and funding limitations did not allow for the additional life tests. Author (TAB)

N66-21224# General Electric Co., Auburn, N. Y. Semiconductor Products Dept.

THE IMPROVEMENT OF PRODUCTION TECHNIQUES TO INCREASE THE RELIABILITY AND IMPROVE PRODUCT CAPABILITY OF HIGH VOLTAGE MINIATURE SILICON RECTIFIERS Quarterly Progress Report, Mar. 31-Jun. 30, 1965

W. R. Comstock, N. E. Devolder, R. R. Schall, and E. G. Tefft [1965] 46 p

(Contract DA-36-039-AMC-06157(E))

(QPR-2; AD-624858) CFSTI: HC $2.00/MF $0.50

Progress is reported on a study devoted to improving the processing techniques used to fabricate a glass encapsulated 1000-volt miniature silicon rectifier, with superior electrical characteristics and reliability performance. Work performed during the reporting period included the empirical design of a process to achieve the proper lifetime control in order to meet the reverse recovery time specification, the design of experiments to evaluate the optimum pellet geometry and doping for reliability purposes, the calculation of the rating of the improved product design, the review of the ability of the improved product design to meet the MIL specification requirements, the use of the computer rating system to set the proper junction temperature value for the matrix testing, further optimization of the improved glass casting process, the evaluation of the redesigned slug and lead assembly, and the delivery of the second engineering samples. Also included is a PERT analysis that depicts the progress of this program and provides certain conclusions regarding the work performed to date. M.R.W.

N66-21234# Joint Publications Research Service, Washington, D. C.

ON THE RELIABILITY OF LOW-POWER LOW-FREQUENCY TRANSISTORS TYPES P13 THROUGH P16

Y. S. Kal'kov 17 Mar. 1966 19 p refs Transl. into ENGLISH from Vestn. Vses. Nauchn.-Issled. Inst. Zheleznodor. Transp. (Moscow), no. 5, 1965 p 45-49

(JPRS-34601; TT-66-31040) CFSTI: $1.00

Results of investigations characterizing the intensity of aging of transistors, types P13 through P16, as function of the ambient temperature and the diffused power are presented. The investigations were performed to determine the life expectancy or reliability of the transistors under high temperature operating conditions. The tests were carried out with temperatures maintained at 40°, 70°, 115°, and 130°C. M.W.R.

N66-21264# General Dynamics/Electronics, San Diego, Calif.

AN/GRC-108 MAINTAINABILITY STUDY, VOLUME I Final Report, 1 Oct. 1963-30 Jun. 1964

Jun. 1965 163 p Reissued

A maintainability study relative to the design of a ground radio communications unit is presented. The program elements include establishment of a daily-liaison working relationship with design engineers, periodic review of schematics and drawings, design evaluation, review of interim design changes, determination of unscheduled maintenance requirements, and determination of preventive maintenance requirements and frequencies. Maintainability task analysis for each subsystem, and maintenance charts are given. Recommendations for special equipment facilities are discussed. N.E.N.

N66-21287# Laboratory for Electronics, Inc., Boston, Mass.

RF DELAY LINE SYSTEM Final Report, Oct. 1964-Jun. 1965

Gunars Grabis Griffiss AFB, N. Y., RADC, Dec. 1965 16 p

(Contract AF 30(602)-3577)

(TP-364; RADC-TR-65-398; AD-626631) CFSTI: HC $1.00/MF $0.50

A report is given on design and development of an RF Delay Line System. Development efforts, which concentrated mainly on the design and development of the system distribution network, were to provide a network which would not attenuate the input signal more than 10 db and would provide sufficient isolation between parallel channels to maintain bandwidth above 8 Mcs. Design requirements of the post delay amplifier were high gain, high output power, and wide bandwidth. Part of the development effort included a search for available state-of-the-art power transistors and the final selection of the 2N3375 type transistor. Transistor cooling and rf radiation problems were solved by using hot tin dipped steel chassis and by separating and shielding each gain stage. Author (TAB)

N66-21294# Radio Corp. of America, Somerville, N. J.
DEVELOPMENT AND EVALUATION OF TRANSISTOR, FIELD EFFECT, INSULATED GATE, 400-MEGACYCLE AMPLIFIER First Quarterly Report, 15 Jun.–14 Sep. 1965
R. W. Ahrons, N. H. Ditrick, and M. M. Mitchell Ft. Monmouth, N. J., Army Electron. Command, Oct. 1965 24 p refs
(Contract DA-28-043-AMC-01453(E))
(ECOM-01453-1; AD-627063) CFSTI: HC $1.00/MF $0.50

During the report period, an assessment was made of the capability of currently available metal oxide semiconductor (MOS) tetrodes to fill the requirement of a 400-megacycle amplifier. In addition, photomasks for the determination of optimum channel length and width for tetrode and pentrode units were designed and fabricated and a capability was developed for measuring the power gain and noise figure of triode, tetrode, and pentode structures at 400 megacycles. Currently available tetrodes yield typical power gain values at 400 megacycles of 10 to 13 dB. This yield is below the contract objective of 20 dB gain at that frequency.
Author (TAB)

N66-21298*# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
METAL OXIDE SEMICONDUCTOR (MOS) TRANSISTOR RESEARCH AND DEVELOPMENT PROGRAM. PART II: DEVELOPMENT OF STABLE COMPLEMENTARY MOS FIELD EFFECT TRANSISTORS Final Report, Mar.–Nov. 1965
(Contract NAS5-3758)
(NASA-CR-70390) CFSTI: HC $2.00/MF $0.50 CSCL 09A

A process for the simultaneous fabrication of complementary enhancement mode MOS transistors in epitaxial material has been developed. The turn on voltages at 10 μa drain to source current is typically +1.5 volts for the N channel and 4.8 volts for the P channel MOS FETs. Stable N and P channel units were delivered November 4, 1965. The process specifications and stability data are enclosed in this report.
Author

N66-21300# Norwegian Defence Research Establishment, Kjeller.
OSCILLATIONS IN TRANSVERSE WAVE TUBES Scientific Report No. 2
A. Nordbotten 15 Sep. 1965 24 p refs
(Contract AF 61(052)-683)
(E-65; RADC-TR-65-470; AD-474716)

The electrons in a beam of finite diameter passing through a Cuccia coupler are velocity modulated in the axial stray field at the entrance to the coupler. For a hollow beam rotating with cyclotron frequency in an axial magnetic field, the resulting beam-loading conductance will be negative for certain combinations of the parameters involved. An oscillator based on this mechanism has been built and tested. The resonant frequency of the cold coupler was about 600 MHz. Oscillations were observed for different operating conditions as expected but the efficiency of the device was rather low. The RF frequency could be changed by varying the axial magnetic field or the axial velocity of the electrons. Experiments with transverse-wave amplifiers have revealed that similar oscillations can occur even when thin beams from magnetically shielded guns are employed, but there seems to be no possibility that these oscillations are due to the same mechanism.
Author (TAB)

N66-21306# Hughes Aircraft Co., Fullerton, Calif.
HIGH POWER MODULATOR SWITCH STUDY (TRANSISTOR) Interim Report, 4 Feb.–10 Aug. 1965
J. V. Stover, J. A. Rogers, and G. Sloan Griffiss AFB, N. Y., RADC, Dec. 1965 62 p refs
(Contract AF 30(602)-3654)
(FR-65-14-188; RADC-TR-65-372; AD-626326) CFSTI: HC $3.00/MF $0.75

The program is a study to determine the feasibility of using commercially available low cost transistors in high power pulse modulator service. Representative types and classes of transistors were selected for measurements at collector pulse current levels greater than the published D-C ratings. Circuit configurations were developed for test and evaluation of the selected transistors and the complementary pair switch element circuit best provides a test vehicle.
Author (TAB)

N66-21332# Fairchild Hiller Corp., Bladensburg, Md. Electronic and Information Systems Div.
THIN FILM MICROCIRCUITS FOR ROCKETSONDE First Quarterly Report, 1 Jun.–31 Aug. 1965
B. J. Patton, P. Berger, and J. Sperling Jan. 1966 66 p refs /ts Rept.-1
(Contract DA-28-043-AMC-01389(E))
(ECOM-01389-1; AD-627993) CFSTI: HC $3.00/MF $0.75

Sample patterns for evaluation of tantalum thin film resistors and capacitors were designed and all necessary art work and photography completed. Elements have been prepared and processed to ensure stabilization prior to testing. Special test fixtures have been designed and completed to facilitate evaluation of component performance. Proposed schedule of testing is provided. Circuit study with regard to the application of miniature components has been undertaken. Evaluation of miniature diode, transistors, and transformers has been applied to the blocking oscillator and the solid state commutator. A thin film version of the blocking oscillator has been studied in breadboard form to compare its performance with one composed of discrete conventional components.
Author (TAB)

N66-21345# Varian Associates, Beverly, Mass. Quantum Electronics Div.
CESIUM BEAM TUBE RESEARCH Second Quarterly Progress Report, 1 Apr.–30 Jun. 1965
Joseph H. Holloway [1965] 25 p
(Contract DA-28-043-AMC-00464(E))
(Rept.-2; AD-624613) CFSTI: HC $1.00/MF $0.50

During this reporting period the design of the beam tube subassemblies to be used in a demountable, bakeable beam optics chamber has been completed, except for the deflecting magnet shielding, the ion optics focusing lens, and some wiring details. Fabrication of the parts for the subassemblies and the main tube was 75% completed. Experimental work has been carried out on problems relating to the coaxial microwave cavity and the field effect transistor.
Author (TAB)

N66-21358# Michigan Univ., Ann Arbor. Electron Physics Lab.
VELOCITY TAPERING IN RING-AND-BAR STRUCTURES Technical Report No. 87

J. L. Mason Griffiss AFB, New York, RADC. Dec. 1965 88 p refs
(Contract AF 30(602)-3569)
(RADC-TR-65-456; AD-626846) CFSTI: HC $3.00/MF $0.75

Cold-test measurements were made on four ring-and-bar slow-wave structures. The effects of dielectric support rods and a shield on the phase velocity and impedance of the structures are shown in a series of graphs. Couplers for use with the structures were designed and are discussed; the elliptic cavity coupler was found to be the best type for the ring-and-bar structure. An S-band medium power traveling-wave tube was built and tested. The design of a velocity-tapered ring-and-bar structure is presented. Author (TAB)

N66-21360# General Dynamics Corp., San Diego, Calif. Special Nuclear Effects Lab.
RADIATION EFFECTS ON DIELECTRIC MATERIALS Quarterly Report No. 1, 1 Jun.–31 Aug. 1965
R. F. Overmyer, D. K. Nichols, and V. A. J. van Lint 17 Dec. 1965 36 p refs
(Contract DA-28-043-AMC-01412(E))
(ECOM-01412-1; GA-6715; AD-626474) CFSTI: HC $2.00/MF $0.50

The report describes the characteristics of the irradiation facilities and the instrumentation used in measuring the transient radiation effects in capacitor dielectric materials. The Accelerator Pulsed Fast Assembly and the TRIGA reactor irradiations of Mylar, mica, ceramic, and tantalum oxide dielectrics are described with some preliminary results included; however, final results await dosimetry data and computer analysis of delayed conductivity components. An effort to compare capacitor transient effects data from various sources is discussed. Analysis of the data and measurement techniques is being carried out in an attempt to resolve some of the discrepancies in reported data. A program of data comparison between General Atomic and IBM is also discussed. A Linac experiment with several mica capacitors indicated that air trapped inside small, molded-case capacitors may be the explanation for some anomalous transient effects measurements. The numerical estimates of neutron induced conductivity and charge transfer in dielectrics have been improved due to the realization that certain approximations used in the derivation cause a much smaller error than formerly supposed. A program has been outlined for verification of the theory using direct irradiation with protons of various energies.
Author (TAB)

N66-21365# Georgia Inst. of Tech., Atlanta.
STUDY OF RECEIVER MIXER CHARACTERISTICS Quarterly Report No. 1, 1 Jun.–1 Sep. 1965
Ernest E. Donaldson, Jr., Robert D. Trammell, Jr., and Richard W. Moss Fort Monmouth, N. J., Army Electron. Command, Sep. 1965 37 p refs
(Contract DA-28-043-AMC-01426(E))
(ECOM-01426-1; AD-623912) CFSTI: HC $2.00/MF $0.50

Mixer phenomena and prediction techniques are reviewed in the light of advanced knowledge of nonlinear device characteristics. Measurement and analysis problems associated with the interdependence of mixer operating parameters are emphasized, and the inadequacies of current prediction schemes are discussed in relation to their application to operational receivers. Tests were performed to determine if the harmonic and response generating properties of nonlinear devices are functions of signal phase relationships. The measurement procedures and instrumentation necessary to measure such relationships are presented. Test results are shown which verify that variations is the phase relationships between the fundamental and harmonics of an injected signal cause radical variations in output harmonic and response levels. It is also shown that the phase of output responses are dependent upon mixer bias level. Author (TAB)

N66-21377# Army Electronics Labs., Fort Monmouth, N. J.
DESIGN OF A HIGH VOLTAGE BREAKDOWN IN VACUUM EXPERIMENT
M. N. Chrepta, J. Weinstein, G. W. Taylor, and M. H. Zinn Jan. 1966 16 p refs
(ARPA Order 517)
(ECOM-2655; AD-628042) CFSTI: HC $1.00/MF $0.50

Although investigators during the past decade have contributed voluminous literature on the mechanism of voltage breakdown in vacuum, there are insufficient data available to permit a straight-forward approach to the design of high-voltage sections of high-power electron tubes. It is concluded that there are at least sixteen variables affecting breakdown. Traditional methods of experimenting by varying one parameter at a time would take years to amass the data on which a cohesive theory could be formulated. A pilot experiment was set up based on the statistical approach to experimental design to evaluate the relative importance of each of the variables. The pilot experiment is a partial replicate of a two-level, full factorial design. It is expected that sufficient information will be collected to permit the elimination of variables having minor effects and to permit a more comprehensive design for the final experiment. Author (TAB)

N66-21382# TRW Semiconductors, Inc., Lawndale, Calif.
TRANSISTOR, VHF, SILICON, POWER TYPE EL-2N (X-3) 5W 500 Mc PEM Quarterly Report, 1 May–31 Jul., 1965
R. Clarke, J. Crishal, J. Rice, and W. Weisenberger [1965] 55 p refs
(Contract DA-36-039-AMC-06163(E))
(QR-1; AD-626849) CFSTI: HC $3.00/MF $0.75

The program plan was completed during the first quarter. Design improvements, principally in the package design, have been made during this quarter to improve the performance of the 10 watt, 500 Mc Research and Development device to meet the 10 dB power gain, 50% collector efficiency goals. Optimized pattern designs were also investigated. Diffusion of the first wafers has taken place with good results. Work on contact metallizing was directed at reducing wafer breakage, emitter-base shorting, and at improving thickness control. Work was started on sputtering of alternate contact metals. Work was started on classification of both wafers and unmolded transistor assemblies. TAB

N66-21390# Kemet Dept., Union Carbide Corp., Greenville, S. C.
DEVELOPMENT OF THIN ORGANIC ROLLED FILM CAPACITOR Quarterly Progress Report, 1 Aug.–31 Oct. 1965
[1965] 34 p
(Contract NObsr-89519)
(QPR-7; AD-627321) CFSTI: HC $2.00/MF $0.50

Progress is reported on a program to improve the characteristics of parylene coated foil capacitor by investigating and improving the various processes involved in manufacturing the capacitor. To develop a metallized parylene capacitor capable of operating over the temperature range of 55°C to 125°C at a rated voltage of 100 VDC, whose capacitance volume ratio is one-half that of a 50 volt metallized Mylar capacitor. Such capacitor to exhibit a dissipation factor less than 0.25%; 250 megohm microfarad minimum insulation resistance at 125°C; temperature coefficient less than

300 ppm/°C; 200% dielectric voltage withstand; less than 5% change in capacitance after life. Author (TAB)

N66-21400# Battelle Memorial Inst., Columbus, Ohio.
SPECIAL REPORT ON MICROELECTRONIC STUDIES, ANALYSIS OF MOS FIELD-EFFECT TRANSISTORS
R. B. Sorkin, J. L. Easterday, J. W. Klapheke, and A. B. Timberlake Johnsville, Pa., Naval Air Develop. Center, 16 Nov. 1965 72 p refs
(NADC-AE-6513; AD-625813) CFSTI: HC $3.00/MF $0.75

The report presents the results of a limited study on the state of the art of MOS field-effect transistors. The study on the MOS field-effect transistors was undertaken to evaluate their potential for integrated circuit applications. TAB

N66-21404# Radio Corp. of America, New York.
TUNABLE SOLID STATE GENERATOR Quarterly Report No. 1, 1 Jun.–31 Aug. 1965
B. Bossard, R. Ernest, S. Yuan, B. Perlman, P. Torrione, et al 4 Oct. 1965 152 p refs
(Contract DA-28-043-AMC-01385(E))
(CR-65-419-17; AD-625310) CFSTI: HC $5.00/MF $1.00

Progress is reported on a program to produce a miniature solid-state tunable source in the 16 Gc/s to 16.5 Gc/s frequency band. A one-half-watt fundamental frequency transistor oscillator that is mechanically tunable from 970 Mc/s to 1040 Mc/s has been completed. In addition, an electronically-tunable frequency oscillator that provides 200 mW to 400 mW tunable from 990 Mc/s to 400 mW tunable from 990 Mc/s to 1035 Mc/s has been developed. Transistor oscillator doublers that generate 2.45 watts at 1000 Mc/s and transistor oscillator triplers that generate up to 2.90 watts in the 1250 Mc/s range have been tested. A Bimode varactor tripler has demonstrated an over-all efficiency of 33 percent at an output frequency of 9.9 Gc/s; an output of 230 mW is generated at X-band. A similar Bimode quadrupler was constructed with an efficiency close to 30 percent and an X-band output of 190 mW. The potential of step-recovery diodes as high-order multipliers is also being investigated. A times-10 multiplier has generated 35 mW at X-band. TAB

N66-21423# Litton Industries, San Carlos, Calif. Research Dept.
RESEARCH ON NOISE IN CROSSED-FIELD GUNS Final Report, Jul. 1, 1963–Jul. 31, 1965
R. P. Wadhwa 31 Jul. 1965 174 p refs
(Contract NObsr-89546)
(AD-628231) CFSTI: HC $17.00/MF $1.00

The requirements for a low-noise injected-beam crossed-field amplifier are discussed. For low-noise operation it is necessary to select parameters so that the diocotron gain in both the gun and drift regions is minimum. It is shown that this can be achieved in the gun region by a proper choice of the largest possible value of the cathode current density and minimum possible values of the cathode width (in the direction of beam propagation) and magnetic field. The other requirements for a low-noise operation, are (1) proper gun design to give laminar flow; the short Kino gun seems to be reasonably good for this purpose, (2) elimination and/or attenuation of spurious modes, (3) use of a high-interaction impedance delay line and positioning of the beam close to the circuit. TAB

N66-21443# Radio Corp. of America, Camden, N. J. Communications Systems Div.
MICROMODULE LIFE TEST PROGRAM Quarterly Progress Report, Mar. 17–Jun. 17, 1965
F. E. Farmar [1965] 39 p
(Contract DA-36-039-AMC-01462(E))
(QPR-3; AD-628012) CFSTI: HC $2.00/MF $0.50

A total of 2682 micromodules remained on life test at the beginning of this quarter and eight failures occurred during this period. The number of failures, accumulated operating time, and best estimate mean-time-to-failure (MTTF) for life testing to date are presented in tabular form. Included in the number of failures for the XM-1364 modules are 33 failures that were caused by inserting the module in the test socket or the life test board in the wrong position. This will provide the wrong voltages to be applied to the module riser wires causing permanent module damage. It is planned to continue testing in subsequent periods until surviving micromodules have each accumulated 10,000 hours of operation.
Author (TAB)

N66-21454# Siliconix, Inc., Sunnyvale, Calif.
TRANSISTOR FIELD EFFECT INSULATED GATE, 100 MC AMPLIFIER Final Report, 1 Dec. 1964–1 Jun. 1965
Gerald L. Parker and Harriet St. John, ed. [1965] 33 p refs
(Contract DA-28-043-AMC-00436(E))

Three n-channel depletion-mode MOS transistors for use in a 100 mc amplifier were designed, manufactured, and tested. The first two devices, MOS I and MOS II, were designed to study high frequency characteristics. MOD I had substantially higher transconductance than MOS II and hence more power gain. The best neutralized power gain of MOS I was 14.5 dB, limited by low transconductance and high input conductance. MOS III resulted from design changes in MOS I. Neutralized power gain was increased to 19 dB with a transconductance of about 2000 micro mhos. The C_{dg} was 0.2 pf (essentially the pin capacitance of the TO-18 package), C_{gs} 3 pf, and C_{ds} 1.5 pf. Devices designed under the contract were minimum geometry designs to maximize the g_{fs}/C ratios. Because of this, the power gain is lower than the 20 dB goal set by the contract. It is concluded from this work that the capacitance must be increased slightly to increase the transconductance necessary to guarantee a 20 dB power gain.
Author (TAB)

N66-21458# Westinghouse Electric Corp., Elkridge, Md.
LOW-POWER INTEGRATED CIRCUITS
[1965] 35 p refs

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1. STATIC AND DYNAMIC PERFORMANCE OF MICROPOWER TRANSISTOR LOGIC CIRCUITS L. F. Wagner and J. D. Meindl (Army Electronics Labs.) 7 p refs (See N66-21457 11-09)

2. INTEGRATED HIGH SPEED, LOW POWER COMPLEMENTARY BIPOLAR TRANSISTOR NAND GATE R. Y. Hung and H. C. Lin 5 p refs (See N66-21458 11-09)

3. MOS MICROPOWER COMPLEMENTARY TRANSISTOR LOGIC M. M. Mitchell and R. W. Ahrons (RCA) 6 p refs (See N66-21459 11-09)

4. A SILICON MONOLITHIC, MICROPOWER COMPLEMENTARY FLIP-FLOP G. Y. Chang 5 p refs (See N66-21460 11-09)

5. A MONOLITHIC SILICON CLASS B HEARING AID AMPLIFIER M. J. Hellstrom and J. J. Hsieh 6 p (See N66-21461 11-09)

N66-21457# Army Electronics Labs., Fort Monmouth, N. J. Integrated Electronics Div.

STATIC AND DYNAMIC PERFORMANCE OF MICROPOWER TRANSISTOR LOGIC CIRCUITS

Lawrence F. Wagner and James D. Meindl *In* Westinghouse Elec. Corp. Low-Power Integrated Circuits [1965] 7 p refs (See N66-21456 11-09)

Implementation of a micropower logic circuit design operating in the range of 1 to 1000 microwatts per gate was studied by using a large signal, dynamic micropower transistor model in worst case analyses of six saturating micropower logic gates. Basic circuits were chosen for their overall performance, producibility, simplicity, low cost, and prior successful usage. Performance characteristics of direct coupled transistor logic, diode transistor logic, and transistor-transistor logic were found adequate for most portable equipment applications. Experimental data taken on monolithic direct coupled transistor logic gates with tantalum thin film resistors, and on a variety of multichip integrated circuits established the greatest speed in multichip circuits since their parasitic capacitance was lowest. G.G.

N66-21458# Westinghouse Electric Corp., Elkridge, Md. Molecular Electronics Div.

INTEGRATED HIGH SPEED, LOW POWER COMPLEMENTARY BIPOLAR TRANSISTOR NAND GATE

R. Y. Hung and H. C. Lin *In its* Low-Power Integrated Circuits [1965] 5 p refs (See N66-21456 11-09)

A modified complementary Nand gate circuitry for high noise margin is described that utilizes a speed-up mechanism in the form of a forward biased p-n-p transistor to provide a low impedance charging path during turn-off time. This mode of operation speeds up turn-off time. Since the bias is set so that the p-n-p transistor is off during steady state condition, steady-state dissipation is not increased. Experimental results with a complete circuit of the complementary Nand gate fabricated in a monolithic form established a turn-on delay of 30 nanoseconds and a turn-off delay of 35 nanoseconds with a fan-out and pulse generator drive. An input versus output waveform of five Nand gates in cascade driven by a pulse generator gave a propagation delay of 80 nanoseconds. G.G.

N66-21459# Radio Corp. of America, Somerville, N. J. Electronic Components and Devices.

MOS MICROPOWER COMPLEMENTARY TRANSISTOR LOGIC

M. M. Mitchell and R. W. Ahrons *In* Westinghouse Elec. Corp. Low-Power Integrated Circuits [1965] 6 p refs (See N66-21456 11-09)

The application of metal oxide semiconductor (MOS) transistors in complementaty logic arrangements is discussed. A basic inverter circuit using n-channel and p-channel enhancement is shown that utilizes transient power supply voltage, multiplied by leakage current from the "off" unit, as quiescent power between the "off" and "on" units. Four-volt operation was found to be feasible by yielding circuit-pair delays of 200 nanoseconds. Single and multielement MOS units are being developed; inherent advantages were found by integrating n- and p- units in one chip. G.G.

N66-21460# Westinghouse Electric Corp., Elkridge, Md. Molecular Electronics Div.

A SILICON MONOLITHIC, MICROPOWER COMPLEMENTARY FLIP-FLOP

G. Y. Chang *In its* Low-Power Integrated Circuits [1965] 5 p refs (See N66-21456 11-09)
(Contract NAS5-3460)

A fully integrated silicon complementary flip-flop has been developed. Currently, the complementary bipolar transistor circuit is considered the most suitable for aerospace and satellite applications because of low power consumption and excellent dynamic characteristics. The integrated device dissipates less than 50 uW in standby over the military temperature range while attaining a counting rate in excess of 1 megacycle. This paper describes circuit development, device design and fabrication of a silicon monolithic complementary flip-flop. Author

N66-21461# Westinghouse Electric Corp., Elkridge, Md. Molecular Electronics Div.

A MONOLITHIC SILICON CLASS B HEARING AID AMPLIFIER

M. J. Hellstrom and J. J. Hsieh *In its* Low-Power Integrated Circuits [1965] 6 p (See N66-21456 11-09)

Described is a balanced preamplifier circuit driving a push-pull output stage that requires a minimum of external hearing aid components beyond the microphone, earpiece, volume control, and battery. This circuit uses direct coupling throughout and employs separate d.c. and a.c. feedback paths. Electrical stability is provided by the balanced circuit used and a high-end roll off in the form of capacitors connected between the second and third preamplifier collectors. If the output signal level increases, the voltage waveform at the transistor base shifts to the negative and is counteracted by an effective bias on the output transistors. Thus, at high signal levels, the amplifier acts as though it has a higher idling current and is free of cross-over distortion. Performance evaluation of this push-pull amplifier showed an idling current of 1 mA and a current drain of 4.2 mA at a rated output of 3 mW. G.G.

N66-21465# Zenith Radio Research Corp., Menlo Park, Calif.

TRANSVERSE-WAVE HIGH-POWER TUBE Second Quarterly Report, Jul. 1-Sep. 30, 1965

C. Burton Crumly and Roy A. Larsen Ft. Monmouth, N. J., Army Electron. Command, Jan. 1966 33 p
(Contract DA-28-043-AMC-01268(E))
(ECOM-01268-2; AD-627912) CFSTI: HC $2.00/MF $0.50

Research and development work is continuing on a novel type of traveling wave power amplifier tube, employing transverse wave interaction between the negative synchronous wave and a circuit wave on a balanced structure. Tests made on the 5-times scale model revealed that it would be necessary to modify the circuit design in order to decrease the lower cutoff frequency. Tests on a 1:1 model have shown that a potentially broadband circuit which will have an insertion loss of 1.5 to 2.0 dB can be fabricated. However, broadband matching to the circuit has not been achieved. A convergent gun has been received, and magnetic field studies were conducted in order to determine the proper positioning of the required magnetic shield. A second cold test circuit was fabricated and work has begun on techniques to match to the highly dispersive circuit. Design work is continuing with the objective of demonstrating the feasibility of a1-kW cw output power at an efficiency of at least 60%, using a depressed collector. TAB

N66-21479# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
PRODUCTION ENGINEERING MEASURE FOR SILICON LINEAR INTEGRATED CIRCUITS Quarterly Progress Report, 20 Apr.–20 Jul. 1965
Robert Mc Ginnis, Thomas Quaid, and John Hatchett [1965] 47 p
(Contract DA-36-039-AMC-06158(E))
(QDR-1; AD-627446) CFSTI: HC $2.00/MF $0.50

This report describes the work accomplished during the first quarterly period in the effort to eventually produce silicon linear integrated circuits of the type used in FM receivers. Most of the effort was devoted to developing the receiver back-end circuits; i.e., the circuits that follow the i-f filter. During the first quarter, circuits designed to replace the IC500 (i-f amplifier), IC501 (limiter), IC502 (squelch), and IC503 (audio amplifier) were breadboarded and tested. The receiver back-end circuits are comprised of three integrated circuits, as outlined below, and a conventional circuit discriminator. (1) IF Amplifier: The four i-f amplifier stages are to be packaged in two TO-5 cans with two amplifier stages occupying the same chip. (2) Limiter/Squelch: Occupying the same chip will be the limiter, squelch noise amplifiers, and the squelch switch. (3) Audio Amplifier: A class B push-pull amplifier was selected after careful comparison with a class A amplifier. Author (TAB)

N66-21482# Hughes Aircraft Co., Newport Beach, Calif. Solid State Research Center.
THIN FILM MICROCIRCUIT INTERCONNECTIONS Final Report
Bob G. Bender and Maurice Yang Oct. 1965 242 p refs
(Contract DA-28-043-AMC-00052(E))
(AD-628225) CFSTI: HC $23.80/MF $1.25

A program of study of deposited thin film interfacial connections and electrical crossovers was completed. Test patterns were designed which permit the study of the interconnection and the crossover with minimal intrusion from contacts and film properties. Processes for the deposition of a variety of materials were developed. Design criteria were established for these materials combinations which are compatible for the purposes of thin film interconnections and crossovers. The use of these criteria can be effective in judging the ability of candidate materials combinations and the ability of each to perform the thin film function. The accuracy of these criteria to perform the task of forecasting the ability of any interconnection or crossover to function in military environments was verified statistically. As a result of the program, all the materials combinations are placed in forced rank according to their relative merits. The reasons for each choice are given. Author (TAB)

N66-21484# Motorola, Inc., Scottsdale, Ariz. Military Electronics Div.
INTEGRATED CIRCUITS FOR COMBAT AREA EQUIPMENT First Quarterly Progress Report, 1 Feb.–1 May 1965
Chester D. Shupe and Robert T. Paca May 1965 55 p
(Contract DA-28-043-AMC-01204(E))
(WP-3081-1; AD-627528) CFSTI: HC $3.00/MF $0.50

During this period the existing discrete component design of the Range Gated Filter was carefully analyzed and an integrated circuit, I/C, replacement was developed. The I/C design was built in bread-board form using such integrated components as transistors and thin film resistors. The breadboard was tested to determine the electrical performance over the specified environmental conditions. Throughout the breadboard evaluation emphasis was placed on small size, low power consumption, reliability and simplicity with no compromise in performance. The final design was submitted to USAEC engineers for review and approval prior to initiation of Phase II which will be the development of the actual I/C chips comprising the Range Gated Filter. The final I/C Range Gated Filter units are estimated to represent a volumetric reduction of 4.3 to 1. Author (TAB)

N66-21485# Mortorola, Inc., Scottsdale, Ariz. Military Electronics Div.
INTEGRATED CIRCUITS FOR COMBAT AREA EQUIPMENT Quarterly Progress Report, 1 May–1 Aug. 1965
Chester D. Shupe and Robert T. Paca May 1965 38 p refs
(Contract DA-28-043-AMC-01204(E))
(WP-3081-2; AD-627932) CFSTI: HC $2.00/MF $0.50

During the reporting period the mask layout was completed and the fabrication of the four individual I/C chips of the Range Gated filter was initiated. The mask layout criteria, the material selection criteria, and the subsequent processing sequences are outlined. Required capacitors for the initial production have been ordered and received. Orders have been placed for the printed circuit boards and connectors. Author (TAB)

N66-21506# Norwegian Defence Research Establishment, Kjeller.
EXPERIMENTAL STUDIES OF UNUSUAL EFFECTS IN FAST CYCLOTRON WAVE AMPLIFIERS Scientific Report No. 3
A. Nordbotten 15 Sep. 1965 12 p refs
(Contract AF 61(052)-683)
(E-66; RADC-TR-66-27; AD-627521) CFSTI: HC $1.00/MF $0.50

Experiments are described with transverse wave amplifiers without pump structure. Two tubes have been built and tested. The first employed three identical Cuccia couplers separated by drift regions. The net gain was strongly dependent on the coupler spacings. The second tube had bellows permitting continuous variation of the distance between the two couplers employed. Net gain was observed, but it was impossible to find any definite correlation between drift length and gain. In addition some experiments with various gun configurations are described. Author (TAB)

N66-21507# Naval Avionics Facility, Indianapolis, Ind.
MINIMAL AREA THIN-FILM R-C CIRCUITS Interim Technical Report
John G. Bennett 29 Nov. 1965 12 p
(NAFI-TR-718; AD-627636) CFSTI: HC $1.00/MF $0.50

The problem of finding the minimal area thin-film R-C circuit with a particular time constant is analyzed with elementary calculus with the conclusion that the circuit has minimal area when the area used by the resistor is equal to the area used by the capacitor, regardless of the resistance of capacitance per unit area. Author (TAB)

N66-21510# California Univ., Berkeley. Electronics Research Lab.
STUDY OF CROSSED-FIELD AMPLIFIERS Ninth Quarterly Progress Report, 16 Jun.–15 Sep. 1965

R. A. Rao, T. Van Duzer, S. P. Yu, G. A. Poe, A. Sasaki, et al
[1965] 22 p refs
(Contract DA-36-039-AMC-02164(E))
(Rept.-9; AD-627469) CFSTI: HC $1.00/MF $0.50

As a part of the project on the shield-gun low noise amplifier, a method of synthesizing crossed-field guns was developed and used to design an electron gun that produces an electron beam having Kino flow characteristics near the cathode and satisfying Brillouin flow conditions near the drift region. Experimental results on the gun built on this basis show excellent agreement with theoretical predictions. The second order corrections to the solution of the first-order paraxial-ray equation used in the synthesis are discussed. The normal mode approach is used to derive the invariant noise parameters of crossed-field amplifiers with an objective to determine the minimum noise-figure. Results of the noise-figure studies based on the field approach are compared with experiment. A simple approximate method to determine the dc potential minimum parameters V_m and Y_m is proposed. The difficulty of determining V_m and Y_m independently is discussed. Important experimental results, verifying a novel statistical theory of the smooth-bore magnetron, are also reported. Author (TAB)

N66-21511# Varian Associates, Beverly, Mass.
THALLIUM BEAM TUBE RESEARCH Fifth Quarterly Progress Report, 1 Aug.–31 Oct. 1965
Richard F. Lacey Jan. 1966 17 p refs
(Contract DA-28-043-AMC-00350(E))
(Rept.-5; AD-627601) CFSTI: HC $1.00/MF $0.50

Measurement of the work function of iridium made by the variation of thallium ion current with temperature of the iridium ionizer resulted in a value of 5.53±.03 eV, compared to 5.40 found for thermionic electron emission. A modification of a previous design for a quadrupole magnet with alnico drivers led to an increase of the field at the pole tips from 6.6 kG to 7.3 kG. This value is still less than the approximately 10 kG obtained by electrically driven quadrupole magnets of similar aperture. Author (TAB)

N66-21517# Texas Instruments, Inc., Dallas. Semiconductor-Components Div.
[THIN FILMS FORMED BY ELECTROCHEMICAL REACTIONS] Supplement to Report No. TI-03-65-112
R. Scot Clark Oct. 1965 9 p
(Contract DA-36-039-AMC-02324(E))
(TI-03-65-112, Suppl.; AD-627850) CFSTI: HC $1.00/MF $0.50

A supplementary report is given which identifies personnel and delineates future plans in a program on thin films formed by electrochemical reactions. The personnel identifications area lists man hours worked and gives biographies of new technical personnel. The future plans area discusses equipment, high sheet resistivity and high capacitance per area films, etching, and gold doping. C.T.C.

N66-21522# Varian Associates, Beverly, Mass. Bomac Div.
PRODUCTION ENGINEERING MEASURE FOR LOW FIELD MAGNETRON BL-234C Quarterly Progress Report, 28 Jul.–28 Oct. 1965
Arnold M. Eklund [1965] 48 p
(Contract DA-36-039-AMC-06162(E))
(QPR-2; AD-627534) CFSTI: HC $2.00/MF $0.50

The cathode investigation was focused on two major cathode types: the presently used nickel matrix cathode and the longer life 'S' type tungsten dispenser cathode. Tube 6S, which contains the Semicon nickel matrix cathode, delivered 900 peak watts of power with low jitter and 350 volt mode width. Tube 7S, containing the standard Bomac nickel matrix cathode, produced 600 watts with a 550 volt mode width and low jitter. The exceedingly good performance of these two tubes is essentially attributed to a change in cathode activation procedure. A tube has been processed to include a directly heated tungsten dispenser cathode. Although problems were encountered with erratic heater operation during hot test, the heater power requirement of these cathodes is only 1/6th of that of the present indirectly heated design. Finish machining a hot hobbed anode was achieved by potting the anode in a plastic compound, rough machining the anode end cavities with an end mill, finishing with a carbide boring bar, and broaching the anode hole with a modified broach. It has been determined that subjecting the potted anode to vibration hardens the copper and permits an improved anode finish as well as a reduction in the size of burrs produced by conventional machining. Work hardening by temperature cycling was also investigated, but no indication of copper hardening was observed. TAB

N66-21525# Radio Corp. of America, Camden, N. J. Communications Systems Div.
MODULES (INTEGRATED CIRCUITS) FOR COMMUNICATIONS Second Quarterly Report, 1 Apr.–30 Jun. 1965
A. M. Hoque Jan. 1966 54 p refs
(Contract DA-28-043-AMC-00454(E))
(Rept.-2; AD-627914) CFSTI: HC $3.00/MF $0.50

The purpose of the "Modules (Integrated Circuits) for Communications" Program is to demonstrate the application of integrated circuits in analog communications equipment, the demonstration vehicle being an IF-video functional assembly for the Mark X IFF Transponder. Four design approaches for implementing the Lin-Log 60-megacycle IF amplifier were investigated. Each design was developed to optimize certain performance functions in the amplifier. Two new analog integrated circuits have been evaluated. The characteristics of these two devices are superior to those evaluated previously. Author (TAB)

N66-21526# Office of Naval Research, Washington, D. C.
THIRD CONFERENCE ON THE NAVY MICROELECTRONIC PROGRAM
[1965] 299 p refs Conf. held at U.S. Naval Postgraduate School, Monterey, Calif., 5–7 Apr. 1965
(ONR-22, Vol. 1; AD-625007) CFSTI: HC $6.00/MF $1.50

Conference papers furthering the exchange of technical information on the state-of-the-art and progress in microelectronics as applied to Navy systems are presented. For individual titles see N66-21527–N66-21560.

N66-21527 Illinois Univ., Urbana.
THE SURFACE AND MICROMINIATURIZATION
Paul Handler *in* ONR Third Conf. on the Navy Microelectron. Program [1965] p 4–7 refs Submitted for Publication (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

Surface effects are discussed which represent properties intrinsic to most semiconductor and insulator surfaces and which must be considered in the design of very thin devices. Properties related to single crystals and polycrystalline films are reviewed, and it is suggested that design of microminiature devices can proceed more quickly by utilizing these properties. M.W.R.

N66-21530 Naval Research Lab., Washington, D. C.
THIN-FILM DIELECTRIC CAPACITORS
F. H. Harris and L. W. Sumney *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 16–24 refs (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

Capacitors have been fabricated on ultra thin evaporated silicon oxide (1000 Å thick, nominal), which had first been examined for flaws or pinholes by a low velocity electron beam probe. This electron beam method is attractive because it is non-destructive and analytical. However, the applicability to capacitor fabrication of the determinations by means of the electron beam were questioned, and this work demonstrates that some of the fabricated capacitors have a uniformity which is consistent with the predictions by electron beam, even though the dielectric strength was considerably lower. Author

N66-21531 Naval Research Lab., Washington, D. C.
RADIATION EFFECTS ON MOS DEVICES
H. L. Hughes *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 25–42 refs (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

Metal Oxide Semiconductor (MOS) transistors have been found to be sensitive to ionizing radiation. The cobalt 60 irradiation of fifty MOS transistors has shown that both bulk and thin film MOS transistors realize permanent degradation in transconductance, pinch-off voltage, and output resistance. The formation of a suitable model to explain the observed degradation is presented. Author

N66-21535 Public Health Service, Washington, D. C. Instrumentation Field Station.
MICROELECTRONICS IN MEDICINE
James K. Cooper and Cesar A. Caceres *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 62–65 refs (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

Microelectronic devices presently used in medicine are very few in number, and are mainly telemetric devices. Possibilities for use of microelectronics in laboratory testing are considered very good, and might include continuous monitoring of heart activity or neurological functions. Miniaturization is considered as a precursor to microelectronics in a general discussion on medical applications for such devices. M.W.R.

N66-21536 California Univ., La Jolla. Scripps Inst. of Oceanography.
SOME SPECIALIZED APPLICATIONS OF MICROELECTRONICS IN OCEANOGRAPHY
James M. Snodgrass *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 66–70 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

The application of hard-wire telemetry to voluntarily expendable instrumentation is discussed as a new approach to electronic technology in the field of oceanography. Functional details of the long-used Navy Bathythermograph are illustrated and discussed; and a trace from such a device, which measures temperature as a function of water depth, is shown. Other devices to determine different parameters are considered within present state-of-the-art microelectronics, which also offers the possibility of improving the effectiveness of underwater weaponry. M.W.R.

N66-21537 Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
MICROELECTRONICS IN SPACE: A LOOK AT MICROELECTRONICS WITH RESPECT TO THE NEEDS OF SPACE ELECTRONIC SYSTEMS
G. J. Veth *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 71–78 refs (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

This paper tries to give a general picture of microelectronics with respect to some of the general design requirements of space electronic systems are considered. Size, weight, reliability, power dissipation, and radiation resistance. Much of the discussion is oriented toward minimization of power dissipation as this is one area in which microelectronics falls short of in comparison with conventional component systems. Author

N66-21538 Bureau of Ships, Washington, D. C.
MICROELECTRONICS PROGRAM—PAST, PRESENT, AND FUTURE
L. D. Whitelock *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 83–95 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

Objectives, past and present applications, and development trends of the Bureau of Ships microelectronics program are discussed. Cost and size reduction, general problems, and reliability are considered; and numerous illustrations show the various types of devices in operation. Problems related to the use of microelectronics are outlined, and advantages of its application to low level circuitry are detailed. About 50 projects currently underway involve such applications of microelectronics. Numerous illustrations are concerned with equipment, reliability prediction, and cost estimation. M.W.R.

N66-21539 Bureau of Ships, Washington, D. C.
MICROELECTRONIC TECHNIQUES
Harold M. Nordenberg *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 96–98 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

Thin film and integrated chip developments in microelectronic techniques are discussed along with certain applications and recommendations for the Navy's Bureau of Ships programs. A short range program has been concerned primarily with stable time and frequency equipment, a frequency synthesizer, and sonar beam forming equipment called DIMUS. While specific application is being made of existing devices, the need for new techniques to produce both improvements and new equipment is considered essential to the long range program, which must be concerned with new processes and materials, improved packaging, and cost and reliability evaluations. M.W.R.

N66-21541 Navy Electronics Lab., San Diego, Calif.
THE MICROELECTRONICS PROGRAM AT THE U.S. NAVY ELECTRONICS LABORATORY
Donald W. Liddell and James V. Kerrigan *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 115–121 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.25

This paper presents an overview of the microelectronics program at the U.S. Navy Electronics Laboratory at San Diego. A description of the microelectronics laboratory facility which is located in a refurbished coast artillery battery on Point Loma is presented. The main features of this facility are its physically stable environment, which contains a clean room in which instrumentation for thin-film research work a

housed; a chemistry and materials laboratory; extensive photographic and mask-making capabilities; and auxiliary laboratory space for an extensive systems applications program. A review of the microelectronics work in device evaluation, systems applications, and techniques investigation is presented. Included are device parameter verification in logic configuration and applications of microelectronics devices in computer and sonar system equipments. Planned work in mass testing and large systems applications, in particular the SS-296 program, integrated with an applied and pure research program is discussed. Author

N66-21542 Naval Applied Science Lab., Brooklyn, N. Y.
MICROELECTRONICS IN INTEGRATED SHIPBOARD SYSTEMS: A "PACED" CONCEPT
T. E. Mc Duffie and P. Giordano *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 127–132 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

Projected advantages of microelectronic techniques, potential uses in electronic systems, and problems in maintenance support and product improvement are described in terms of a PACED concept for integrated shipboard systems. It is shown that the Navy Data Bank can be used in conjunction with computer techniques to evaluate the current impact of microelectronics on equipment and to pinpoint areas where further developments are necessary. Techniques discussed include micro-power microelectronic applications, advanced design and thin film techniques for linear circuits, microelectronics requirements for advanced sonar designs, and digital systems. Microelectronics assurance provisions are considered, along with value engineering analyses of various system configurations and advanced packaging concepts. In addition to the PACED concept, which is primarily a software approach, future work must be concerned with hardware validation. M.W.R.

N66-21543 Signetics Corp., Sunnyvale, Calif.
AN ECONOMICAL FLAT PACKAGE FOR INTEGRATED CIRCUITS
B. David James and Robert C. Byrne *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 135–141 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

A monolithic structure for encapsulation of integrated devices has been designed and demonstrated to be feasible, but storage life and environmental tests must be evaluated before the worth of the package can be shown. The flat, solid structure, package incorporates a means to establish electrical contact between the integrated circuit device and the external leads without the use of internal lead wires. Package development is described in terms of five developmental tasks, dealing with the first seal, interconnect pattern, integrated circuit bond, the final seal, and reliability and quality assurance. It is pointed out that by applying the correct metal film interconnect pattern, more than one integrated circuit device could be encapsulated in a package. Crossovers can be obtained in the integrate circuit chip or by fabricating special crossover dice. M.W.R.

N66-21544 Texas Instruments, Inc., Dallas.
MICROELECTRONIC VERSION OF THE AN/URQ-13
Arlie Teel *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 142–150 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

A microelectronic frequency and time standard to use semiconductor networks to the maximum possible extent has been designed. Solid circuit devices have been used in the time base, dividers, power supply regulators, frequency standard oven control, and the oscilloscope sweep duration and intensity marker controls. In addition, "master slice" design techniques were used to design semiconductor networks to contain the 5-megacycle frequency standard circuitry and the circuitry for most of the distribution amplifier. The system has the capability of 18 hours of battery operation in case of input power failure. Each frequency standard is similar to the AN/URQ-10 and is capable of operating on its own internal battery power for 24 hours over an environmental temperature range of 0° to 50°C without degradation in performance characteristics. The system reliability design goal is 10,000 hours MTBF, but the current estimate is 14,000 hours MTBF. Author

N66-21545 Westinghouse Electric Corp., Baltimore, Md.
A MICROELECTRONIC VLF/LF FREQUENCY SYNTHESIZER
W. R. Olson *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 151–159 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50
(Contract NObsr-87593)

Satisfactory performance has been achieved for nine circuits in connection with the development of microelectronics for use in time and frequency control equipment. The circuits meet environmental requirements of shock, vibration, humidity, and temperature ranges from −40 to +120°C. Among the devices are a 50 mc flip-flop which consumes less than 100 mw of power; a universal analog block for use as a frequency mixer or multiplier, an rf or if amplifier, or an isolation amplifier; and an analog gate with over 100 db isolation between input and output. A new high density packaging concept is described which permits economical fabrication and easy module replacement. A newly-constructed frequency synthesizer, which is less than 1/40 the size of a comparable conventional solid state device, exhibits improved reliability with no sacrifice of electrical performance. M.W.R.

N66-21548 Melpar, Inc., Falls Church, Va.
MATERIALS AND CIRCUITS FOR THIN FILM MONOTRONICS
Charles Feldman and Charles E. Gane *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 191–201 Sponsored by Bur. of Naval Weapons (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

Progress in high temperature thin film materials and circuits is reviewed, and the use of such advances is considered in the development of a prototype for a monotronic, high-gain ac summing amplifier. Because of its broad application in the electronics industry, such an amplifier, which achieves 60db gain at 400 cycles in all thin film circuitry, is considered a good example of monotronics. Monotronics is used to imply a single technique electronics, which is to be distinguished from microelectronics or integrated, molecular, or hybrid circuits. Passive components for the circuit were fabricated from rhenium resistors and silicon-boron oxide capacitors; and the active devices were formed from chromium source-drain conductors, silicon dielectrics and aluminum gate electrodes. The entire circuit of 10 substrates was packaged in an evacuated stainless steel can. M.W.R.

N66-21549 Hughes Aircraft Co., Fullerton, Calif.
TRANSIENT RADIATION EFFECTS RESEARCH ON THIN FILM ELECTRONICS
T. D. Hanscome In ONR Third Conf. on the Navy Microelectron. Program [1965] p 202–207 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

Radiation induced disturbance in the drain current high temperature thin-film insulated-gate field-effect transistors (TFT) contains components which are both unique and common to any electronic device. Built-in gate voltage and effective drift mobility are unique to TFTs; and leakage in the gate insulator may be considered a specific TFT effect since the leakage interacts with device performance. Injected currents and ionization leakage in the ambient, however, are generally not peculiar to TFTs. Delayed decay in conductivity, which is observed for the data presented, probably involves the population or depopulation of slow states by the radiation pulse. The time constant associated with the fast states can be observed in the rapid rise of drain current after the beginning of the pulse. Since the responses which are unique to TFTs appear to be related to the conduction process and to the relation between traps, charge carriers, and carrier lifetimes, it is recommended that transient radiation effects should be interpreted in terms of the TFT solid state parameters. M.W.R.

N66-21550 Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

NUCLEAR RADIATION EFFECTS ON THIN FILM MICROELECTRONIC DEVICES

R. A. Freiberg *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 208–214 Sponsored by Bur. of Naval Weapons and DASA (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

An insulated-gate thin-film field-effect transistor (TFT) with a CdSe channel, and a configuration using the same gate-channel geometry of the TFT were irradiated by a 10 Mev electron beam from a linear accelerator. The accelerator currents ranged from 50 to 300 ma in one to three microsecond pulses. The devices were in evacuated stainless steel cans. Measurements were made at various biasing conditions on the TFT and at various voltages across the gate-source configuration. The current produced by the ionizing radiation was measured during and after the pulse of radiation. Author

N66-21551 Naval Radiological Defense Lab., San Francisco, Calif.

NUCLEAR DOSE EFFECTS ON AN INSULATED-GATE THIN-FILM TRANSISTOR

H. A. Zagorites *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 215–221 refs (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

On the basis of limited test results, it is shown that the threshold of ionizing doses for significant semi-permanent surface effects in insulated-gate thin-film transistors (IGTFT) is well above the expected nuclear weapon gamma dose. These measurements, the results of which may have some significance in space applications, were made during relatively long exposures and, therefore, effects resulting from fast surface states could not be observed. Results are presented for evacuated or potted units; and it is speculated that many of the observed effects could be enhanced in the presence of an easily ionized gas medium. Since the effects in the IGTFT are found to depend on the direct interaction of radiation-induced charges with potential gradients in the device, the influence of such charges should be considerably less than in bulk semiconductors. A summary is presented of the nature of semiconductor surface effects and their possible influence on IGTFT performance. M.W.R.

N66-21552 Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

APPLICATION AND DEVELOPMENTS OF THIN FILMS TO SURFACE LAUNCHED MISSILES Progress Report

William Liben *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 222–235 (See N66-21526 11-09) (Contract NOw-62-0604-c)
CFSTI: HC $6.00/MF $1.25

Four microelectronic systems in various stages of fabrication are described: (a) a thin-film 0.4 μs delay line; (b) a thin-film dc operational amplifier; (c) a thin-film decoder; and (d) a thin-film oscillator gyro temperature controller, a summing amplifier and a modulator/demodulator. Results of research on a field-effect thin-film transistor, and high temperature rare-earth oxide dielectrics are also presented. Author

N66-21553 Naval Avionics Facility, Indianapolis, Ind.

ADVANCED ELECTRONIC FABRICATION TECHNIQUES

William R. Coffey *In* ONR Third Conf. on the Navy Microelectron. Program [1965]– p 236–246 refs Sponsored in Part by Bur. of Naval Weapons (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

Processing, manufacturing techniques, and applications of advanced electronic fabrication techniques are discussed for specific projects underway at the Naval Avionics Facility. These include programs related to thin film process development, product improvement and evaluation, the interconnection of microcircuit modules and devices, standard hardware developments and interface definitions for shipboard electronics, and advanced packaging techniques for microelectronics. Mention is also made of a thin film six-bit decoder and microcircuit modules for possible application in a telemetry base station. M.W.R.

N66-21554 Naval Ammunition Depot, Crane, Ind.

THE CONTRIBUTION OF μ-NOTES TO MICROELECTRONICS DESIGN

L. Eccles *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 247–48 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

Technical information on application, research and development, standardization, and evaluation of microelectronic circuits, devices, and materials is presented in the bi-monthly newsletter μ-NOTES. The NAD Crane microelectronics program has the responsibility of conducting tests on evaluation on commercially available microelectronic assemblies as well as correlating these findings with various vendors and equipment contractors. Contributions and related information are actively sought from all Navy laboratories. M.W.R.

N66-21555 Naval Air Development Center, Johnsville, Pa.

SUMMARY OF NAVAL AIR DEVELOPMENT CENTER MICROELECTRONIC APPLICATION PROGRAMS

Ross Mullen *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 249–251 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

In-house and contracted projects of the Naval Air Development Center are summarized. Thin film microelectronic fabrication and development, as well as development of equipment using both thin film and solid state integrated circuits are within the present capability of the Center. Brief reviews are given of various projects at the Center and those performed under contract. In a project dealing with the sputtering of rhenium for resistors, it was found for satisfactory sputtering the chamber must be thoroughly outgassed at low pressure before and during deposition. A technique is described which

will permit the mounting of discrete components and thin film circuits inside the package to augment semiconductor integrated devices. Mention is made of the A-NEW project to obtain optimum tactical anti-submarine warfare capabilities through the development of an integrated avionics system. M.W.R.

N66-21556 Naval Air Development Center, Johnsville, Pa.
APPLICATION OF MICROELECTRONICS TO A-NEW AIRBORNE ASW EQUIPMENTS
H. M. Steinberg *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 252–255 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

Microminiature techniques are considered to offer increased reliability, easier maintainability, and size reduction in the A-NEW system, an airborne system to counteract the growing submarine menace. A microelectronic version of an interface unit for A-NEW, called a Manual Entry Subsystem (MES), is to function between the antisubmarine warfare (ASW) sensor stations and the digital computer. This MES, which is illustrated, will use 1500 integrated circuits housed in 14 lead flat packs and 200 thin-film circuits in 16 lead packages. The flat packs will be packaged using 3-D techniques that are interconnected on a cordwood module. A modular approach has been applied to microminiaturization of the CP-642A, USQ-20 NTDS computer. The importance of microelectronics in improving the role of carrier-based ASW aircraft is stressed. M.W.R.

N66-21557 Teledyne Systems Corp., Hawthorne, Calif.
IHAS SYSTEM APPLICATION OF BULK SEMICONDUCTOR DEVICES
George Kozmetsky *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 256–259 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

The impact and future possibilities of microelectronics on integrated helicopter avionics systems (IHAS) is discussed. Reduced size, weight, and power; decreased cost; and increased reliability are considered as the obvious advantages of IHAS application to bulk semiconductor devices. Proper operation and improvements for the central computer, the heart of the IHAS set-up is considered. The IHAS computer uses active binary microelectronic elements to replace much of the thin film memory core in the more conventional computer; cost of this flop-flop storage is remarkably low. Modular microelectronic implementation produces an extremely high computation rate. It is pointed out that in discussing such new developments in avionics systems it is important to consider the microelectronic ramifications in support equipment needed for repairs and maintenance. M.W.R.

N66-21558 Fairchild Semiconductor Corp., Palo Alto, Calif.
DESIGN CONSIDERATIONS FOR MICROELECTRONIC SYNCHRO-DIGITAL AND DIGITAL-SYNCHRO CONVERTERS
Robert H. Katzive *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 260–281 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

This paper discusses the use of semiconductor integrated circuits and other microelectronic components in military environment synchro-digital and digital-synchro Conversion Systems. A system currently under development is analyzed as an example, with discussion on system and subsystem design features, and computer interface and system implementation. Maximum emphasis is placed on how integrated circuits can be used in appropriate applications within the system. Author

N66-21559 Philco Corp., Lansdale, Pa.
AN INTEGRATED 60 MC I-f AMPLIFIER
C. G. Thornton and R. L. Luce *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 282–283 refs Sponsored by Bur. of Naval Weapons (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

Developments are described which are applicable to the fabrication of high performance monolithic linear circuits which do not have the design compromises and parasitic elements of previously developed circuits. A 60 Mc intermediate frequency amplifier was selected as the vehicle to indicate how further research and development will extend the contribution of microelectronic techniques to the fabrication and performance of military equipment. Investigations planned to reduce parasitics and area size and to improve production are outlined. M.W.R.

N66-21785# Naval Research Lab., Washington, D. C. Electrochemistry Branch.
LOGARITHMIC SWEEP FOR USE IN DISPLAY OF LONG PULSES IN ELECTROCHEMICAL TRANSIENT MEASUREMENTS Interim Report
C. H. Presbrey, Jr. 5 Jan. 1966 7 p ref
(NRL-6355; AD-627346) CFSTI: HC $1.00/MF $0.50

The incorporation of a logarithmic sweep in an oscilloscope would be useful in the study of certain time-potential changes occurring at electrode surfaces. High quality oscilloscope circuitry was modified to accommodate experimental log adapter units. With careful adjustment, the final circuit can provide an accurate one, two, or three decade logarithmic sweep in a display range from 5 to 10,000 microsec. Inherent limitations in the oscilloscope circuitry reduce accuracy in the 1-microsec range of the log sweep. Improved performance at the initiation of the sweep is dependent upon the development of superior horizontal sweep generator and amplifier circuitry. Author (TAB)

N66-21769*# Continental Testing Labs., Inc., Orlando, Fla.
SEMICONDUCTOR DEVICE QUALIFICATION TESTS, GENERAL SPECIFICATION
[1965] 83 p *Its* Rept.-11253-8-1
(Contract NAS8-11253)
(NASA-CR-71410) CFSTI: HC $3.00/MF $0.75 CSCL 09A

Environmental and electrical tests were conducted on a silicon, fused, n-p-n, power transistor intended for use in voltage and current regulators, amplifiers, and high power switching circuit applications. Tests included visual examinations, life tests, moisture resistance, shock tests, strength, and power cycling. It was concluded that, within certain limitations, the semiconductor device met the specification requirements. N.E.N.

N66-21775*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
REDUCTION OF ELECTRICAL NOISE AND CROSSTALK IN GUIDANCE SYSTEM COMPONENTS Progress Report, Sep. 1965
L. J. Little 15 Oct. 1965 14 p
(Contract NAS8-20118)
(NASA-CR-71545; LMSC/HREC-A712335) CFSTI: HC $1.00/MF $0.50 CSCL 09C

Four servo loop modules (a buffer amplifier–detector, two servo amplifiers, and a power amplifier) were inspected for physical and electrical layout characteristics. Particular attention was directed toward the signal flow and decoupling parameters, and problem areas are identified. Recommendations for improved circuitry are also given. N.E.N.

N66-21785*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
A STUDY OF CdS THIN-FILM VACUUM-ANALOG TRIODES
Anthony A. Aponick Dec. 1965 35 p refs
(Grant NsG-496)
(NASA-CR-71552; ESL-TM-247) CFSTI: HC $2.00/MF $0.50
CSCL 09A

Previous investigations of thin film gold structures on CdS have shown that gridlike structures with 40–50 percent open area, and sheet resistance 12–50 Ω/sq can easily be fabricated. An investigation is made of the possibility of incorporating these structures into active vacuum analog devices. Solutions to two of the basic problems in achieving this goal are presented and discussed. The first of these problems, that of insulating the grid structure from the CdS in which it is imbedded is solved by using aluminum grid material and insulating it with a combination of blocking contact and oxide insulating layer. The second of these problems, that of achieving a nonlinear conduction law in essentially ohmic polycrystalline CdS, is solved by employing an emitter which makes blocking contact to the CdS. The grid is then used to pull electrons over the barrier thus induced in front of the emitter. The characteristics of such a device which operates in the expected way, but which produces less than unit gain, are presented. Author

N66-21836# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SPACE RADIATION EFFECTS ON HIGH GAIN LOW CURRENT SILICON PLANAR TRANSISTORS
Alan G. Stanley 25 Oct. 1965 85 p refs Revised *Its* Group Rept.-1965-11
(Contract AF 19(628)-5167)
(ESD-TDR-65-506; AD-627605) CFSTI: HC $3.00/MF $0.75

The availability of silicon planar transistors with dc gains up to 300 at 10-microamps collector current has made it possible to design circuits with very low power consumption. By irradiating a number of commercial types with 1.5 MeV electrons in different circuit configurations, they were shown to be rather susceptible to space radiation. The most sensitive parameters are leakage current and low current gain. The effect on saturation voltages and on matching characteristics of transistor pairs was found to be minor, as long as the dc gain did not fall below 10. Under prolonged irradiation at electron fluxes representative of the inner Van Allen belt most transistor types had leakage currents considerably less than 100nA at emitter-collector biases not exceeding 10V. A few types exhibited leakage currents as high as 500 microamps A due to the formation of surface channels. A total dose of 10^{15} e/sq cm reduced the dc gain in the 5- to 10-microamps A range of most transistors to values between 5 and 20. The gain after irradiation was governed by recombination–generation in the base-emitter region, but did not depend significantly on the pre-irradiation gain. Encapsulation of the transistor chip in a dense plastic material proved to be an effective method of preserving the gain under irradiation with a minimum penalty in weight and volume. Author (TAB)

N66-21878# Reeves-Hoffman Div., Dynamics Corp. of America, Carlisle, Pa.
SINGLE SIDEBAND QUARTZ CRYSTAL UNITS FOR VHF APPLICATIONS (METAL ENCLOSURES) Second Quarterly Progress Report, 1 Aug.–30 Oct. 1965
George E. Ritter [1965] 74 p refs
(Contract DA-28-043-AMC-01325(E))
(Rept.-2; AD-626181) CFSTI: HC $3.00/MF $0.75

The new coldweld enclosure with dimensions conforming with the HC-6/U is on order. The available transistor coldweld enclosure was accepted by the government representative at the last conference. Some brazing difficulties were experienced, however, the problems are being resolved. Most of the modifications needed for the thermocompression bonding apparatus are completed and preparations are being made to adapt a method to employ AT resonators in the holding fixture. The glass bonding technique has been centered around the sodium silicate as a bonding agent. A major problem developed when high temperature, vacuum tests were conducted on the bonding material; the gold plated electrodes lose adherence to the quartz at high temperatures. The vacuum bakeout chamber is being fabricated. The particular arrangement will allow the bakeout and sealing of the resonator units to take place in the same vacuum environment. The quartz resonator design is nearly completed and only some minor adjustments of electrode and ZZ' angle are needed. An aging facility was constructed and it is now being aged before employment. Author (TAB)

N66-21879# Bell Telephone Labs., Inc., Murray Hill, N. J.
MICROWAVE DIODE RESEARCH First Interim Report, 10 Jun.–9 Sep. 1965
J. G. Josenhans and T. Misawa Ft. Monmouth, N. J., Army Electron. Command, Dec. 1965 34 p refs
(Contract DA-28-043-AMC-01445(E))
(ECOM-01445-22; AD-626469) CFSTI: HC $2.00/MF $0.50

Chapter 1 describes room-temperature microwave measurements that have been made to characterize an epitaxial silicon p-n-n+ avalanche diode in continuous operation. The diode is believed to have an avalanche somewhat distributed throughout the depletion layer as contrasted to the Read model in which the avalanche is confined to a narrow zone within the depletion layer. The diode exhibits a negative conductance over a band in excess of an octave about a center frequency in the 5- to 10-Gc range. However, a large current-dependent susceptive component places constraint on the utilization of this negative-conductance band. The noise power output in the negative-conductance band was functionally related to the bias current; however, the noise figure of a high-gain amplifier was only moderately influenced because of the diode's increased negative conductance with bias current. The typical noise figure of a 10-db amplifier was 45 db. In Chapter 2 a one-dimensional, small-signal analysis of the space-charge region of a p-n junction in which avalanche occurs uniformly is presented. The impedance is well represented by a parallel connection of the depletion layer capacitance, an inductance, and a negative resistance. The admittance of the latter two is proportional to the bias current. The magnitude of the negative Q is below ten. The negative resistance is due to an intrinsic instability in the avalanching electron hole plasma. A discussion of the instability and a traveling-wave-tube type of amplification is given. TAB

N66-21882# Westinghouse Electric Corp., Philadelphia, Pa.
PRODUCTION ENGINEERING MEASURE: TYPE 2N2282 FAMILY SILICON ALLOY TRANSISTORS Final Report, 22 Jun. 1963–25 Nov. 1965
R. J. Pisarcik, J. Priest, and R. Harm [1965] 190 p
(Contract DA-36-039-AMC-03617(E))
(AD-626182) CFSTI: HC $5.00/MF $1.00

Data are presented that illustrate an improvement in the secondary breakdown characteristics of the device due to the improved method of junction termination. Improved handling

of base assembly and reduction in the thickness of the molybdenum mounting disc are two process improvements developed independently of the contract program but included as additional steps toward reliability improvement. Critical control of the starting material during Phase III of the production run illustrated a definite improvement in the distribution of higher voltage devices. The results presented for the high temperature step-stress test program illustrate an improvement in the reliability of devices fabricated using techniques refined during the course of the contract program when compared to those fabricated using standard procedures.
Author (TAB)

N66-21947# California Univ., Livermore. Lawrence Radiation Lab.
LOW INDUCTANCE CAPACITORS [MALOINDUKTIVNYE KONDENSATORY]
V. V. Konotop, V. Ya. Linetskii, and S. M. Fertik [1965] 15 p refs Transl. into ENGLISH from Elektrotekhnika (Moscow), v. 1, Jan. 1965 p 23–26
(UCRL-TRANS-1273(L)) CFSTI: HC $1.00/MF $0.50

Possible means of reducing the self-inductance of high-voltage capacitors are considered, and a description is given of eight types of capacitors having a low self-inductance. A "self-inductance quality factor" is proposed to allow comparison of the capacitors.
Author (NSA)

N66-21961# Sandia Corp., Albuquerque, N. Mex.
REDUCTION OF 600 2N1051 TRANSISTORS TO A SPECIFIED GAIN BY NEUTRON BOMBARDMENT
C. M. Tapp and A. R. Phillips Jun. 1965 11 p
(Contract AT(29-1)-789)
(SC-RR-65-224) CFSTI: HC $1.00/MF $0.50

Six hundred transistors of initial gain distribution of 45→≈100 were reduced to a distribution of 40→45 in 10 irradiation steps.
Author (NSA)

N66-21988# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
APPLICATIONS OF FIELD EFFECT TRANSISTORS IN LOW NOISE WIDEBAND VOLTAGE AND CHARGE SENSITIVE PREAMPLIFIERS Scientific Report No. 5
T. V. Blalock and J. F. Pierce 15 Mar. 1963 38 p refs Prepared for Oak Ridge Natl. Lab.
(Contract W-7405-ENG-26)
(TID-21901) CFSTI: HC $2.00/MF $0.50

Low noise wideband voltage and charge sensitive preamplifiers using field-effect transistors in the input stages were designed, constructed and tested. The basic amplifier section is a field-effect transistor driving a bipolar transistor cascade. Experimental data are included to indicate the performance characteristics of these amplifiers. One of the voltage sensitive amplifiers described has an input resistance greater than 10 megohms, input capacity less than three picofarads, a 10-90% risetime of 300 nanoseconds, a gain of 950, and an equivalent noise voltage at the input of 5.6 microvolts rms. The noise resolution of the charge sensitive preamplifiers discussed is about 12 kev fwhm for a detector capacity of 25 picofarads. A qualitative discussion of pertinent field-effect transistor theory is given. The necessary amplifier noise terminology for interpretation of the performance of these preamplifiers is presented.
Author (NSA)

N66-21950# California Univ., Berkeley. Lawrence Radiation Lab.
AN AMPLITUDE-INDEPENDENT NANOSECOND TIMING DISCRIMINATOR FOR FAST PHOTOMULTIPLIERS
Donald L. Wieber and Harlan W. Lefevre 12 Oct. 1965 18 p refs . Presented at the 12th Nucl. Sci. Symp. of IEEE, San Francisco, 18–20 Oct. 1965
(Contract W-7405-ENG-48)
(UCRL-16227; CONF-651001-14) CFSTI: HC $1.00/MF $0.50

A circuit was developed which reduces amplitude-dependent timing errors to less than 0.2 nsec over a dynamic amplitude range of more than 100 to 1. The anode signal is clipped, and a pedestal added, allowing adjustment of the discriminator to the true "zero-crossing" point. Tunnel diodes are used as threshold devices and pulse shapers. A version of this circuit adapted to RCA-2067 photomultipliers is described which features a pulse-recognition threshold variable from <1 to 10 mA and a pulse-pair resolution of <15 nsec. In tests performed with a mercury-light pulser and in coincidence experiments with plastic scintillation counters, the time delay through this discriminator was found to be essentially independent of the signal amplitude over the linear range of the photomultipliers.
Author (NSA)

N66-21998# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
ON INACCURACIES OF AMPLITUDE-TO-TIME CONVERTERS [O POGRESHNOSTYAKH AMPLITUDNO-VREMENNYKH PREOBRAZOVATELEI]
V. I. Prikhod'ko and V. G. Tishin 9 Oct. 1965 12 p refs In RUSSIAN
(JINR-P-2394)

The influence of the following factors is estimated: nonlinear capacitance of the charging diode and current-stabilization transistor resistances shunting the storage capacitance, and reverse resistance of the charging diode. Theoretical and experimental curves of the differential non-linearity for the amplitude-to-time converter are constructed with account of the factors considered.
NSA

N66-22031# Sandia Corp., Albuquerque, N. Mex.
A PRECISION ANALOG MEMORY WITH NONDESTRUCTIVE LEADOUT USING MULTIAPERTURE FERRITE CORES
Andrew C. Wilken Aug. 1965 15 p refs
(Contract AT(29-1)-789)
(SC-R-65-959) CFSTI: HC $1.00/MF $0.50

The utilization of a square loop multiaperture ferrite core in conjunction with solid state switches results in a device that is capable of nondestructively interrogating the flux content about the core's minor aperture. The minor aperture flux can be controlled by a signal applied to the major aperture. The minor aperture flux quantity is the frequency controlling element of a readout oscillator which is the interrogator. There is, therefore, an analog input to frequency output which can be easily calibrated. The circuit can be operated in a completely passive mode at all times except during the interrogation cycle. The information, once stored as a flux reversal in the multiaperture core, can be maintained for an infinite time interval or until reset.
Author (NSA)

N66-22048# Sandia Corp., Albuquerque, N. Mex.
THE VOLTAGE-SWITCHING CLASS-D AMPLIFIER
T. W. H. Caffey Jul. 1965 7 p ref
(Contract AT(29-1)-789)
(SC-DR-65-338) CFSTI: HC $1.00/MF $0.50

Circuit operation of the voltage-switching type of the Class-D amplifier and details of comparison with Class-C service are discussed. Some practical work with the Class-D amplifier is described and a problem pointed out.
Author (NSA)

N66-22154# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Servizio Documentazione.
DESIGN OF A PRESSURIZED SPARK-GAP [PROGETTO DI UNA SPARK-GAP PRESSURIZZATA]
L. Cerioni, F. Losciale, and G. Ubaldini 26 Jan. 1965 12 p ref In ITALIAN *Its* Note No. 268
(LNF-65/2)

The design, construction, and operational behavior of a pressurized spark-gap with small dimensions, good resistance of the electrodes, and small delay are presented. The forming circuit for the trigger pulse is also given. NSA

N66-22156# Princeton Univ., N. J. Elementary Particles Lab.
DISTRIBUTION OF SINGLE ELECTRON PULSE SIZES FROM MULTIDYNODE ELECTRON MULTIPLIERS Technical Report No. 2
George T. Reynolds, D. P. Hutchinson, and P. Botos, Jr. 16 Aug. 1965 31 p refs
(Contract AT(30-1)-3406)
(NYO-3406-2) CFSTI: HC $2.00/MF $0.50

The spectrum of light pulse sizes at the anode of a transmission secondary electron multiplier image tube was determined at room temperature and dry ice temperature, for noise, or dark current pulses, as well as for single photoelectrons leaving the cathode. The noise distribution shows two main groups of pulses. The first group obeys a nearly exponential distribution, with a small contribution from the first dynode. The second group consists of a broad distribution of larger pulses, and may be due to ion bombardment of the cathode. The nearly exponential group is reduced by a factor of 4 by cooling, but the second group is not significantly affected. The size distribution of anode pulses from single photoelectrons is monotonically decreasing but deviates significantly from an exponential. The gain of the tube as determined from the pulse height distribution agrees well with that determined by a direct method, and is consistent with a loss of between 10 and 50% of the photoelectrons in the first dynode.
Author (NSA)

N66-22160# David Sarnoff Research Center, Princeton, N. J. Conversion Devices Lab.
PHOTOMULTIPLIER INVESTIGATION Summary Report, 15 Jun. 1964-14 Mar. 1965
H. M. Smith, Jr. and R. Wasserman 14 Apr. 1965 43 p
(Contract AT(30-1)-3421)
(NYO-3421-3) CFSTI: HC $2.00/MF $0.50

Two problems often encountered are those of dark pulses and gain shift with count-rate or short-term stability. Investigations have been made on the causes of these problems. With regard to the dark current problem, many tubes have been studied and some of their similarities and differences are analyzed. All tubes examined appear to exhibit three types of dark pulses, namely, thermionic electron pulses, non-thermionic "single" electron pulses and non-thermionic "multi-electron" pulses. These three types have been studied with respect to a wide range of tube parameters. Appropriate instrumentation has been developed for the study of the stability problem. A survey of the pulse height shift in a number of commercial tubes is now underway. Author (NSA)

N66-22182*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MICROELECTRONICS
Charles Husson [1964] 25 p refs Submitted for Publication
(NASA-TM-X-56533) CFSTI: HC $1.00/MF $0.50 CSCL 09A

Out of the technologies used to obtain microminiature circuits has evolved a discipline called microelectronics. Photolithography and the chemical and physical processes in materials are united to provide building blocks of electronic systems which are extremely small and reliable. Microelectronics enables a direct, rapid, and effective solution to many of the problems of present day science including not only those of electronic and aerospace disciplines, but to an increasing degree, those of biology and the medical sciences. Author

N66-22344*# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
DEVELOPMENT OF ELECTRICAL SWITCHGEAR FOR SPACE NUCLEAR ELECTRICAL SYSTEMS Quarterly Progress Report No. 5, Dec. 4, 1965-Mar. 4, 1966
A. H. Powell, ed. [1966] 54 p
(Contract NAS3-6467)
(NASA-CR-54924) CFSTI: HC $3.00/MF $0.50 CSCL 09A

Work efforts towards developing and designing ground prototype AC circuit breakers and DC engine contractors, suitable for, and tested under anticipated launch and space nuclear electrical system requirements, are described. Actuators for operating the vacuum capsule were assembled and placed in test; the interrupter units were trial assembled, and two vacuum capsules are in the process of being assembled. A check and bake-out of the endurance test oven was successfully completed. The vacuum interrupter includes a supporting shell, heat transfer and insulating parts, and terminals with current-carrying members to mount and attach the vacuum capsule. The capsule, the heart of the breaker and contactor, and the supporting members (interrupter unit) are discussed. Photographs of the testing oven, interrupter unit, vacuum capsule, ion pump, and other electrical switchgear units are presented, along with several schematic diagrams and calibration curves. L.S.

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N66-21185# Rome Univ. (Italy) School of Aerospace Engineering.
PROGRAMMED CIRCUITS FOR SCIENTIFIC SATELLITES [CIRCUITI PROGRAMMATORI PER SATELLITI SCIENTIFICI]
Bruno Ratti Dec. 1965 32 p refs In ITALIAN
(Rept.-11) CFSTI: HC $2.00/MF $0.50

The system characteristics are defined and the general criteria are discussed for the solid state programmed microcircuitry of the San Marco scientific satellite. Flow charts, schematics, and circuit diagrams are included.
Transl. by O.T.

N66-21282# Weapons Research Establishment, Salisbury (Australia).
THE EQUIVALENT CIRCUIT OF A MITRED BEND IN PARALLEL PLATE LINE WITH APPLICATIONS TO TEM MODE TRANSMISSION LINES AND WAVEGUIDES
H. E. Green Jan. 1966 25 p refs
(WRE-SAD-154) CFSTI: HC $1.00/MF $0.50

Methods are given which permit the deduction of the inductance and capacitance of a bend of arbitrary angle in a parallel plate transmission line. To find inductance a theorem relating to the magnetic field inside a long conducting cylinder of arbitrary cross-section is first proved. Capacitance is obtained numerically by an extension of earlier work on finite difference theory. This work is applied in determining the characteristic impedance of coaxial lines formed of conductors which are regular prisms, the cutoff wavelength for higher order modes of propagation in these lines, and the cutoff frequency of a ridged waveguide. As a limiting case an excellent approximate formula is also derived which expresses in closed form the cutoff wavelength of higher order (TE) modes in coaxial line. It is to be noted that throughout this paper rationalized MKS units have been used exclusively. Author

N66-21348*# Purdue Univ., Lafayette, Ind. Control and Information Systems Lab.
ON THE ASYMPTOTIC STABILITY OF FEEDBACK CONTROL SYSTEMS CONTAINING A SINGLE TIME-VARYING ELEMENT
Z. V. Rekasius, and J. R. Rowland Jan. 1966 96 p refs
(Grant NGR-15-005-021; Contract AF-29(600)-3566)
(NASA-CR-71400; TR-EE-66-2) CFSTI: HC $3.00/MF $0.75
CSCL 09C

Three contributions are presented in this thesis. The first shows that the Popov criterion, a powerful stability result developed for feedback systems having a single time invariant nonlinearity, does not apply without modification when the nonlinear characteristic varies with time. The damped Mathieu equation provides a counter example for the desired purpose. In the second contribution, a frequency domain criterion is developed to guarantee global asymptotic stability for systems containing a time varying nonlinear element in the loop. The improved criterion uses additional information related to the rate at which the nonlinear characteristic varies with time. The third is the sinusoidal criterion which guarantees asymptotic stability for linear feedback systems containing a single sinusoidal gain. The latter two criteria are independent of the system order. The stability sector width for each criterion depends on the transfer function of the linear plant and additional information about the time rate at which the separate element varies. Examples are provided to illustrate the particular effectiveness of each criterion. Results are evaluated from the viewpoint of their importance to the field of stability theory. R.N.A.

N66-21361# City Coll. Research Foundation, New York.
ELECTROSTATIC FOCUSING OF HOLLOW SPIRALING ELECTRON BEAMS Quarterly Report No. 3, 5 Jul.–5 Oct. 1965
Morris Ettenberg [1965] 47 p
(Contract DA-28-043-AMC-00466(E))
(Rept.-3; AD-626839) CFSTI: HC $2.00/MF $0.50

A third experimental model (SBT-3) for a spiral beam trajectory was designed and constructed. The model showed about 75% beam transmission. A MAD computer program for electron trajectories in cylindrical coordinates (including space charge) is appended. TAB

N66-21431# Illinois Univ., Urbana. Coordinated Science Lab.
A PROCEDURE FOR SYNTHESIS OF SWITCHING NETWORKS
Archie Charles Mc Kellar May 1965 55 p
(Contract DA-28-043-AMC-00073(E); Grant NsF GK-36)
(R-253; AD-618333) CFSTI: HC $2.00/MF $0.50

A procedure is described which yields a realization of a sequential machine as any asynchronous switching network. The basic idea is to perform an operation on the flow table which corresponds to opening a feedback loop of some realization. Repetition of such operations leads to the specification of a combinational network which is considered to be a solution to the problem. In addition to being iterative, the procedure is capable to being implemented on a digital computer. Necessary and sufficient conditions for the existence of asynchronous cascade and parallel realizations are given and methods of obtaining such realizations are explored. It is shown that the steady state behavior of a sequential machine is useful in this regard. Author (TAB)

N66-21470# Federal Electric Corp., Paramus, N. J.
A TECHNIQUE FOR PREDICTING THE ELECTROMAGNETIC ENVIRONMENT AT A SITE Final Engineering Report, Supplement
1966 35 p ref
(Contract NObsr-91236)
(AD-627676) CFSTI: HC $2.00/MF $0.50

The report contains the step-by-step procedures for applying the technique to obtain a measurement of the electromagnetic environment at a site with a minimum of actual field measurement. This technique has been designed to be used to determine whether an equipment planned for installation at a site can be expected to encounter interference from distant (on or off-base) transmitters. It is based on signal intensity behavior as a function of calendar time and frequency and produces results in the form of 'the percentage of total time over the course of a year when the signal intensity for a given frequency received at a site, will be above a given level.' By knowing the threshold level of the particular equipment being considered for installation, it is possible to determine whether the signal intensity levels expected will present a significant problem and whether redesign efforts or other approaches for eliminating or reducing the interference are needed or desired. Author (TAB)

N66-21590# European Organization for Nuclear Research, Geneva (Switzerland). Proton Synchrotron Machine Div.
EXCITATION OF DELAY-TYPE MAGNETS BY SHORT PULSES
H. Fischer 17 Jan. 1966 17 p refs
(CERN-66-1)

An excitation method for delay-type magnets is described which has the following advantages: (1) the voltage is across the magnet for a time which is an order of magnitude less, and (2) the energy to be stored and dissipated is reduced by a factor of two. Author

N66-21659*# Massachusetts Inst. of Tech., Cambridge. Electronics Systems Lab.
ADD: ON-LINE SYNTHESIS OF LOGIC CIRCUITS
Michael L. Dertouzos and Paul J. Santos, Jr. Dec. 1965 91 p refs
(Grant NsG-496)
(NASA-CR-71418; ESL-R-253) CFSTI: HC $3.00/MF $0.75
CSCL 09A

The central aim of logical design is the synthesis of any given switching function in terms of given sets of elementary building blocks, for the optimization of some performance index in the presence of constraints. Although the present

"state of the art" yields algorithmic methods for the solution of certain specific instances of the problem, no fully algorithmic method exists for the solution of the more general problem. The system described in this paper gives solutions to the general problem by use of an online process, where the machine accomplishes those computational tasks which can be algorithmically specified, and where the user provides those decisions which he is better qualified to make. The machine portion of the system is based on a set of heuristic procedures which guarantee convergence of the process. The machine behaves in an "intelligent" fashion using successive local-optimization procedures and does not depend on impractical exhaustive searches through all possible solutions. Author

N66-21671 International Business Machines Corp., San Jose, Calif. Research Lab.
OPTIMUM CONTROL OF A CLASS OF MIXED DISTRIBUTED AND LUMPED PARAMETER SYSTEMS
P. K. C. Wang *In its* Papers on the Control of Distributed Parameter Aeroelastic Systems Nov. 1965 p 84–104 refs (See N66-21666 11-01) CFSTI: HC $5.00/MF $1.00

The problem of optimum control of a class of mixed distributed and lumped parameter systems are considered. The mathematical model for the system is in the form of a coupled system of equations consisting of a scalar linear partial differential equation and a first-order vector linear ordinary differential equation. Classical variational techniques are used to derive the optimum control equations. The problems associated with the optimum control of systems whose distributed and lumped parameter subsystems are weakly coupled to each other are also considered. The meaning of some of the results is interpreted in the framework of two physical problems pertaining to the control of temperature in a solid and the pitching motion of a simplified flexible aerodynamic vehicle. Author

N66-21674 International Business Machines Corp., San Jose, Calif. Research Lab.
THEORY OF STABILITY AND CONTROL FOR DISTRIBUTED PARAMETER SYSTEMS An Annotated Bibliography
P. K. C. Wang *In its* Papers on the Control of Distributed Parameter Aeroelastic Systems Nov. 1965 p 141–164 refs (See N66-21666 11-01) CFSTI: HC $5.00/MF $1.00

A bibliography providing an up-to-date collection of references pertaining to the theory of stability and control for distributed parameter systems is presented. The bibliography only includes those works which deal directly with distributed systems in the form of partial differential equations or integral equations, and excludes all those works which deal only with the approximate forms of distributed systems without justification for the validity of approximation. Also excluded are works pertaining to distributed parameter systems which are desirable by ordinary differential-difference equations. The bibliography is divided into sections; the first section is devoted primarily to works on the theory of optimum control of distributed parameter systems and the second section is devoted to works on the theory of stability for such systems. This division is merely for the purpose of clarification and does not represent the intent of divorcing stability theory completely from optimum control theory. M.R.W.

N66-21746# Norwegian Defence Research Establishment, Kjeller.
TRANSVERSE WAVE INTERACTION IN ELECTRON DEVICES Annual Summary Report No. 1, 1 Mar. 1963–1 Sep. 1965
W. Thon 30 Sep. 1965 14 p refs
(Contract AF 61(052)-683)
(E-68; RADC-TR-66-26; AD-627522) CFSTI: HC $1.00/MF $0.50

Experimental evidence was accumulated regarding amplification of 600 MHz by means of a thin electron beam and two Cuccia couplers (no pump structures). Gains up to 30 db were readily reproducible, but the RF power output was less than one milliwatt at a few percent efficiency. Tuning by the dc magnetic field and by the beam voltage was demonstrated. The process seems to depend upon dc modes excited in the beam by its irregular injection into the magnetic field. Experiments with an oscillator based upon a hollow beam and a single Cuccia coupler are also included. Author (TAB)

N66-21876# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electronics.
NONLINEAR ANALYSIS OF A MICROWAVE BEAM-PLASMA AMPLIFIER Technical Note No. 6
B. Geidne 1965 45 p refs *Its* Res. Rept.-52
(Contract AF 61(052)-594)
(RADC-TR-66-28; AD-627530) CFSTI: HC $2.00/MF $0.50

This paper deals with the linear and nonlinear field theory of an idealized, radially finite beam-plasma amplifier model. Both the beam and the plasma are assumed to be made up of infinitesimal, rigid, circular discs with a charge to mass ratio equal to that of the electron. Radial motions and finite temperature effects are not considered. Thus the main purpose of the theory, which is purely analytical, is to describe as simply as possible the effect of finite radial boundaries upon the basic linear and nonlinear properties of beam-plasma devices. Linear amplification and bandwidth, non-linear generation of second and third harmonic signals and distortion of the fundamental are studied. Author (TAB)

N66-22043# Temple Univ., Philadelphia, Pa.
STUDIES OF PHOTOEFFECTS OCCURRING WITH ANODIZED NIOBIUM ELECTRODES
Robert Aloysius Schell (Ph.D. Thesis) Jun. 1964 121 p refs
(Contract AT(30-1)-2775)
(TID-21972) CFSTI: HC $4.00/MF $0.75

Open circuit photopotentials and short circuit photocurrents were observed with anodized niobium electrodes. The open circuit photovoltaic effects was generally well described by the theory of van Geel, et al., and Salomon. The relaxation phenomena was interpreted in terms of a non-equilibrium effect by which the photoexcited electrons take a rather long time to reach thermal equilibrium with the oxide lattice. The short circuit photocurrents exhibited a maximum when viewed as a function of the oxide film thickness. This was explained on the basis of optical anisotropy in the oxide film. The spectral response curves of the short circuit photocurrent were very unusual. The fact that there was not correspondence between these curves and the absorption spectra was rather surprising. An explanation was given in terms of interband transitions. The peaks in the curves are to correspond to optical excitations of electrons to band regions where the mobility is high. The valleys would

correspond to excitations to band regions of lower mobility. A trapping scheme is postulated to explain the current–light curve characteristics. This is based on an exponential distribution of traps. The superlinearity is interpreted in terms of a redistribution of these trapping states upon illumination. In addition to the short circuit photocurrents, normal photocurrents were also observed. The shape of the spectral response curves are similar to those of the short-circuit photocurrent for the range of applied fields investigated. Author (NSA)

N66-22103# Panoramic Research, Inc., Palo Alto, Calif.
A SELF-ORGANIZED SYSTEM CALLED "MICKEY MOUSE"
Research Report, Year Ending Mar. 1964
Iben Browning Apr. 1964 40 p
(Contract AT(29-1)-789)
(SC-RR-65-212) CFSTI: HC $2.00/MF $0.50

A simulated "neural net" was operated on large computers. In this net, quasi-random interconnections of neuroids (i.e., simulated neurones) are made through synapsoids (simulated synapses). The latter are the sites which are modifiable. The network has feedback through an "external" function generator. The system as a whole has demonstrated limited "ability" to organize itself, to learn and forget, to repair itself, and in general to exhibit "behavior." It responds to "pain-like" inputs. Future experiments are suggested. Author (NSA)

N66-22245# General Electric Co., Syracuse, N. Y. Electronics Lab.
UNIFIED ANALYSIS OF THE BILINEAR FOUR FREQUENCY VARACTOR MIXER
C. E. Nelson and J. A. Reeve May 1965 63 p refs
(R65ELS-41)

A special group of varactor microwave mixers are analyzed in which there is both a sinusoidal signal and pump input and an upper and/or lower sideband output. The varactor mixers considered are one- or two-diode mixers operating with a fixed dc bias voltage and operating in the bilinear mode, i.e., the conventional signal-to-output channel is essentially linear and the conventional pump drive is low (not saturated) such that the pump-to-output channel is also essentially linear. The linear power conversion gain for six types of varactor coupling networks is determined. The deviation from linear operation, phase and amplitude (conversion gain) distortion, is determined separately for both increasing signal and pump levels. The main emphasis is upon the third-order nonlinear term. The intermodulation produced at the output for two closely spaced (in frequency) input signals in the same channel is related to the phase and amplitude distortion of a single input signal. Author

N66-22336* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOME SUFFICIENT CONDITIONS FOR MINIMAX CONTROL
Thomas E. Carter *In its* Aero-Astrodyn. Res. Rev. No. 3 15 Oct. 1965 p 47–53 (See N66-22329 11-34) CFSTI: HC $4.00/MF $1.00

Presented are the initial efforts of a mathematical investigation to determine sufficient conditions for solution of a class of optimal control problems in which the quantity to be minimized is the peak value of some measure of performance of the control. This work was motivated by the fact that many guidance and control problems can be formulated as problems of this class, yet very little theoretical work has been done in this area. Some theorems are developed which apply to this class of problems. A similified version of a booster control problem known as the constrained bending moment minimax drift problem is used as a model for application of the theorems. Some conjectures are made regarding extending the work to other minimax problems. Author

N66-22374# National Aeronautics and Space Administration, Washington, D. C.
RADIO CONTROL OF ROCKETS
M. V. Maksimov and G. I. Gorgonov [1964] 724 p refs Transl. into ENGLISH of the book "Radioupravleniye Raketami" Moscow, Izd. Sov. Radio, 1964
(NASA-TT-F-367) CFSTI: HC $7.25/MF $3.50 CSCL 09C

This book presents the principles of design and elements of the theory of systems for the radio control of rockets and radio fuses. Emphasis is on the various aspects of electronic components of the control apparatus. The fact that these components are dynamic links of control systems is taken into account in the analysis. In addition, considerable attention is devoted to analysis of radio control systems as a whole, with different types of perturbations being considered. The book is intended for radio engineers and students at advanced radio engineering technical schools and corresponding divisions at universities. It also can be useful for non-specialists in this field who are interested in methods of radio control of rockets. Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N66-21114# HRB-Singer, Inc., State College, Pa.
MOBILE GROUND TRUTH LABORATORY Final Report
Harry Balmer, William Cramer, Robert Gray, and Frederick Ranck Griffiss AFB, N. Y., RADC, Jan. 1966 74 p
(Contract AF 30(602)-3461)
(RADC-TR-65-277; AD-627243) CFSTI: HC $3.00/MF $0.75

The Mobile Ground Truth Laboratory (MGTL) was to be capable of recording radiological and meteorological data for use in studies of airborne sensor capabilities. Major design features were oriented to a self-sufficient unit able to operate both on and off improved roads in remote areas under various environmental conditions. The basic vehicle supplied for modification was a USAF M-109 shop van shown in figure 1. Instrument types were listed in the purchase request which would enable accurate records of physical phenomena to be obtained under a wide range of weather conditions. The major contractor-supplied equipment requirements were: Continuous temperature recording to ±2° continuous relative humidity recording to ±5%; continuous wind velocity and direction recording to ±3 mph and the nearest 15 degrees, respectively; apparent radiation temperature in the infrared spectrum from 1 to 30 microns recorded by a single channel radiometer in a form that temperatures to 1°F may be determined (provisions for the collection of

data restricted to the 3 to 5 micron and 8 to 14 micron bands were also required); a transportable, well-regulated power supply capable of providing continuous operation of all equipment in the laboratory. TAB

N66-21192# Army Electronics Labs., Fort Monmouth, N. J.
COMPACT ANECHOIC CHAMBER FOR PRODUCTION TESTING VHF ANTENNAS
W. P. Czerwinski Nov. 1964 19 p refs
(ECOM-2514; AD-609918) CFSTI: HC $1.00/MF $0.50

The need for a production-line facility which permits making impedance measurements, matching network adjustments, and power handling tests of a VHF antenna without radiating a signal, led to the exploratory experimental investigation of a compact R-F anechoic chamber. Design criteria were evolved which resulted in a reasonably small chamber while simulating free-space environment for all kinds of tests except pattern measurements. Author (TAB)

N66-21315# College of Aeronautics, Cranfield (England).
THE CRANFIELD HELIUM HYPERSONIC WIND TUNNEL: TUNNEL, PLANT AND INSTRUMENTATION
D. R. Clark Nov. 1965 27 p refs
(CoA-AERO-186) CFSTI: HC $2.00/MF $0.50

The philosophy behind the use of helium as a wind tunnel working fluid is discussed and its advantages over air for the simulation of flows of high Mach number and high Reynolds number are presented. Much of the report is devoted to the design and construction of a helium tunnel and the detailed operation of both plant and instrumentation. A brief outline is given of the tunnel operating range and the type of work which is projected for the future. Author

N66-21375# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
DEVELOPMENT AND OPERATION OF AN ELECTRICAL-RESISTANCE AIR HEATER FOR THE ARL TWENTY-INCH HYPERSONIC WIND TUNNEL
Richard T. Goddard and David H. Murray Nov. 1965 63 p refs
(ARL-65-226; AD-628614) CFSTI: HC $6.60/MF $0.75

An electrical resistance heater has been designed and fabricated to preheat the air in the 20-inch hypersonic wind tunnel of the Fluid Dynamics Facilities Laboratory located at Wright-Patterson Air Force Base. The heater was designed to heat air to 2800°R at mass flow ranges of one-half pound per second to ten pounds per second. Stagnation pressure can be varied between 600 psi to 2500 psi. The report traces the development of the present heater and includes a heat transfer analysis required to design this type of heater. In addition, a comparison is made between experimental and theoretical results. The heater described in the report has been successfully operated for several hundred hours during a three year period. The report presents recommendations that might be made to improve this highly essential component. Author (TAB)

N66-21492# Columbia Univ., Irvington, N. Y. Nevis Labs.
MODIFICATION PROGRAM FOR THE NEVIS SYNCHRO-CYCLOTRON
James Rainwater Jan. 1966 161 p refs With Yale Collaboration Studies (Appendix II)
(Contract Nonr-266(72))
(R-536; CU-250; NEVIS-144; AD-627351) CFSTI: HC $5.00/MF $1.00

The plan envisages an eventual conversion to 500-600 MeV proton kinetic energy and $\geq 10\,\mu A$ time average current. It is hoped to obtain a high extraction efficiency which will permit a 10 to 50 μA time average external proton beam current having a high duty factor, with corresponding high intensity pion and muon beams. This program will involve a major building and shielding, etc., extension. It is planned to use spiral ridge iron shims with $<B(r)>$ (average over azimuth) increasing with r more slowly than for isochronism, but by an amount which will give a greatly reduced rf frequency swing. This should permit a repetition rate of about 300/sec. The design study will rely strongly on the use of one-fifth scale cyclotron model magnet for field studies. Using a vacuum system, ion source, frequency modulated rf system, etc., it will also be used for central region studies using spiral ridge iron shimming. This model operating FM cyclotron may also be used for a partial investigation of extraction modes where the protons would emerge along a high spiral angle valley field contour. Author (TAB)

N66-21512# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
A THEORETICAL ANALYSIS OF THE DRIVER-RESERVOIR METHOD OF DRIVING HYPERSONIC SHOCK TUNNELS
Robert F. Flagg Apr. 1965 39 p refs
(Contract AF 33(615)-2766)
(UTIAS-TN-93; AD-627571) CFSTI: HC $2.00/MF $0.50

The driver-reservoir method of extending the test time of a tailored hypersonic shock tunnel by using a reservoir and a nozzle (perforated plate) at the upstream end of the driver is treated theoretically. It is shown that the flow following the rupture of the diaphragm is highly complex and contains both steady and unsteady flow regimes. It is also shown that the area ratio of the nozzle separating the driver from the reservoir determines the nature of the wave system produced. For a unique or 'ideal' nozzle area ratio a flow system is produced which contains no downstream running disturbances other than Mach waves. That is, both the head and the tail of the initial rarefaction wave are prevented from interfering with the shock-tunnel reservoir. Consequently, the running time of the shock tunnel can be extended. The ideal area ratios are calculated for a wide range of shock tunnel operating conditions and compared with experimental results. The comparison shows that the ideal nozzle area ratio can be predicted accurately from theory. Author (TAB)

N66-21560 Sperry Gyroscope Co., Great Neck, N. J. Information and Communications Div.
ASPECTS OF SPECIAL-PURPOSE COMPUTATION AND DIGITAL CONTROL IN THE MICROCIRCUIT LORAN-C RECEIVER
James Meranda *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 284-291 ref (See N66-21525 11-09) CFSTI: HC $6.00/MF $1.50

The ARN-78 Loran-C receiver is shown to demonstrate the application of digital microcircuits, so that real time digital control and computation can be readily performed at the subsystem or detector level. Design approach of the receiver, which is compatible with a wide range of mission requirements, permits operation independently or coupled via data link as part of an information and control network or modular avionics system. The synchronous serial construction of the computational portion of the receiver, which is separable from the main unit, permits integration with a computer complex which will perform the more specialized navigation missions. M.W.R.

N66-21586# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
PERFORMANCE OF THE KYOTO UNIVERSITY LOW DENSITY PLASMA JET WIND TUNNEL
Goro Kamimoto, Takeyoshi Kimura, and Koji Teshima Nov. 1965 41 p refs
(CP-7) CFSTI: HC $2.00/MF $0.50

In order to investigate a low density, high-enthalpy, high-speed flow with chemical reactions such as dissociation, recombination, ionization and neutralization, a low density plasma jet wind tunnel has been constructed. Performance tests have been carried out on nitrogen and argon plasma jets. Stagnation temperature of up to 5000° K can be obtained in both plasma jets. Author

N66-21904# ARO, Inc., Arnold Air Force Station, Tenn.
RESULTS OF AN EXPERIMENTAL INVESTIGATION OF THE PERFORMANCE OF AN EXPANSION TUBE Technical Report, 3 Jul. 1963–29 Jan. 1965
Glenn D. Norfleet, John J. Lacey, Jr., and Jack D. Whitfield Arnold Eng. Develop. Center, Feb. 1966 67 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-10; AD-628628) CFSTI: HC $6.60/MF $0.75

The results from an experimental study of an expansion tube conducted at the von Karman Gas Dynamics Facility (VKF) are presented and discussed. The research was conducted in two facilities: (1) a 6.75-in.-diam Modified Expansion Tube (MET) which utilizes a partially steady and partially unsteady expansion process, and (2) a 4-in.-diam (constant diameter) High Density Shock Tube (HDST) operated in an expansion tube mode for a completely unsteady expansion of the shock-heated gas to the final test condition. Flow velocities from approximately 9000 to 16,000 ft/sec were studied. The theoretical performance of expansion tubes in terms of velocity is found to be nearly obtained; however, the steadiness of the resulting flow leaves much to be desired, and the definition of accurate flow conditions remains in serious doubt. Author (TAB)

N66-21948# Stanford Univ., Calif. Linear Accelerator Center.
STREAMER CHAMBER DEVELOPMENT
F. Bulos, A. Boyarski, R. Diebold, A. Odian, B. Richter, and F. Villa Sep. 1965 36 p refs Presented at the 5th Intern. Conf. on High Energy Accelerators, Frascati, Italy, 9–16 Sep. 1965
(Contract AT(04-3)-400)
(SLAC-PUB-140; CONF-650923-25) CFSTI: HC $2.00/MF $0.50

Some properties of the streamer chamber are presented. Special attention is given to the practical use of large-volume chambers as particle detectors. In particular, the following problems are discussed: pulsing large-volume chambers; reducing the rather long memory of the chamber by suitable quenching; amplification of the light output by the use of image intensifiers with large photocathode area. All measurements are made on straight tracks from particles of various energy. Scatter and curvature fitting as well as ionization measurement (using gap length technique) are presented. Author (NSA)

N66-22000# Union Carbide Nuclear Co., Oak Ridge, Tenn.
EQUIPMENT FOR INDICATING, RECORDING AND CONTROLLING OSCILLATIONS OF THE AXIS OF ROTATION AND THE SPEED OF THE ROTOR OF A GAS CENTRIFUGE
W. Paap, H. Mitscherlich, and K. Gunschmann 21 Feb. 1963 7 p Transl. into ENGLISH from German Patent (Appl. No. 1144195, 15 Mar. 1961)
(K-TRANS-5)

Equipment is described for indicating, recording, and controlling oscillations of the axis of rotation and the speed of the rotor of a centrifuge rotating on a pin like a top and held in a vertical position by magnets. The device consists of at least one coil which surrounds a section of the stray field of the magnets and which is connected by an amplifier to a signaling, indicating, or recording instrument or to a correction device. NSA

N66-22049# Vanderbilt Univ., Nashville, Tenn.
EFFICIENCY OF HIGH PRESSURE ELECTRIC SHOCK TUBES
Terrill Wayne Mayes (M.A. Thesis) Aug. 1965 51 p refs
(Contract AT(40-1)-1087; Grant AF-AFOSR-287-64)
(TID-22061) CFSTI: HC $3.00/MF $0.50

An experiment was conducted to better understand the operation of electric shock tubes so that a shock tube could be assembled which would produce a shock velocity of about Mach 25 at a pressure of a few hundred torr. The performance of three types of electric shock tubes, each of which is operated at gas pressures between 200 and 760 torr, is studied. NSA

N66-22116# Dynatech Corp., Cambridge, Mass.
INVESTIGATION OF BOILING FLOW REGIMES AND CRITICAL HEAT FLUX Quarterly Progress Report, 6 Mar.–15 Jun. 1965
A. E. Bergles, L. G. Clawson, P. Goldberg, M. Suo, and J. G. Bourne 1 Aug. 1965 25 p refs *Its* Rept.-582
(Contract AT(30-1)-3304)
(NYO-3304-5) CFSTI: HC $1.00/MF $0.50

Completed and anticipated modifications to the experimental facility are described. Recent experimental results for flow regimes in a 2-ft, 0.4-in. ID test section are discussed. The oscillatory instability associated with this test section is considered in detail. The general effects of pressure and length on flow regimes are also considered. Author (NSA)

N66-22138# Istituto Superiore di Sanita, Rome (Italy). Laboratori de Fisica.
OPTIK 2: A PROGRAM FOR MAGNETIC CHANNEL DESIGN [OPTIK 2: UN PROGRAMMA DI CALCOLO DELL'OTTICA DEI CANALI MAGNETICI]
G. Carloni and G. Fronterotta 1 Feb. 1965 75 p refs In ITALIAN; ENGLISH summary
(ISS-65/4)

A program to aid the design of magnetic channels for high energy particles was developed. The program was prepared for the IBM 7040 computer of the Laboratories of Physics of the Istituto Superiore di Sanita. The program based on the OPTIK program due to T. J. Devlin (UCRL-9727) was improved to meet some specific needs. The computation is done introducing the usual six component vector to represent position, direction, momentum spread and mass of the beam particles. Problems of focusing of the beam may be solved by imposing single or double focusing or parallelism in either plane and finding the corresponding values of quadrupole strength. Slit effects are evaluated through the limitation of the phase space referred to the source. Author (NSA)

N66-22162# Mound Lab., Miamisburg, Ohio.
SHOCK TUBES: A BIBLIOGRAPHY (SUPPLEMENT I)
Arnold M. Melnick 17 Dec. 1964 10 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1189, Suppl.-I; M-3679) CFSTI: HC $1.00/MF $0.50

A total of 65 classified reports are listed. Author and subject indexes are included. NSA

N66-22174*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PERFORMANCE OF A COMBUSTION DRIVEN SHOCK TUNNEL WITH APPLICATION TO THE TAILORED-INTERFACE OPERATING CONDITIONS
William J. Loubsky, Robert S. Hiers, and David A. Stewart [1964] 14 p refs Presented at the 3d Conf. on Performance of High Temp. Systems, Pasadena, Calif., Dec. 1964
(NASA-TM-X-54960) CFSTI: HC $1.00/MF $0.50 CSCL 14B

Quasi-steady reservoir conditions are achieved by controlling the mass flow into the driven tube with throttling plates employed near the main diaphragm section and by reducing the initial unsteady expansion strength by using a large volume driver. The complex wave system in the driven tube sections is analyzed for 20 msec using a wave diagram and two computer programs which account for real gas effects and multiple interface-end-wall reflections. Shock velocities in the range of 8,000 feet per second to 15,000 feet per second were obtained experimentally, agreeing with the computed values to within 3 percent. It is shown experimentally that total pressure equilibrium in the shock tube can be obtained after the upstream passage of the reflected shock wave for a wide range of initial pressure loadings. This condition was also found to be particularly sensitive to the sonic orifice area of the plates. Experimental pressure levels in the driven tube were found to be in reasonable agreement with predictions. The tailored interface mode of operation was approximately determined within the limitations imposed by the presence of a finite contact surface region. Author

N66-22226*# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
MAN-SYSTEM LOCOMOTION AND DISPLAY CRITERIA FOR EXTRA-TERRESTRIAL VEHICLES Progress Report
Dec. 1965 67 p
(Contract NAS8-20015)
(NASA-CR-71757) CFSTI: HC $3.00/MF $0.75 CSCL 14B

This report covers profiles made in studying human performance capabilities in vehicle control tasks on a simulated lunar surface. Both fixed and mobile base simulators are described along with their objectives. Since mission success is dependent on the external environment and the vehicle configuration, knowledge of obstacle recognition and vehicle factors affecting the driving task is needed. To accomplish this the study includes two phases. The first involves determining the effects of major lunar visual factors such as sun inclination, lunar photometric properties, and obstacle size on man's performance of the driving task. The second phase will examine such vehicle factors as field of view, crew environment, task loading, and control mode. Test schedules for the mobile and fixed base simulators were devised to permit comparison of results. This correlation of data will be used to validate and improve the fixed base simulator for more detailed investigations. R.N.A.

N66-22257*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
DESCRIPTION AND RESEARCH CAPABILITIES OF THE LANGLEY LOW-FREQUENCY NOISE FACILITY
Philip M. Edge, Jr. and William H. Mayes [1965] 16 p refs Presented at the 69th Meeting of the Acoust. Soc. of Am., Washington, 2-5 Jun. 1965
(NASA-TM-X-56563) CFSTI: HC $1.00/MF $0.50 CSCL 14B

To determine possible effects of low-frequency noise associated with the launching of large spacecraft, an acoustic facility to operate in the frequency range from 1 to 50 cps was constructed. This facility makes use of a large, hydraulically driven speaker to generate sound-pressure levels of the order of 160 dB in a chamber of sufficient size to environmentally test full-scale manned spacecraft. This paper contains brief discussions of some low-frequency noise research problems, the overall design features of the facility, its operating characteristics, and its research capabilities. Author

N66-22354*# Northrop Space Labs., Hawthorne, Calif.
FOLLOW-ON STUDIES AND INVESTIGATION RELATED TO THE CHEMICAL HAZARDS POTENTIAL STUDY Final Report
M. S. Christensen Mar. 1966 269 p refs
(Contract NAS9-4795)
(NASA-CR-65321; NSL-65-136-1) CFSTI: HC $6.00/MF $1.50 CSCL 14B

This study has explored the hazards entailed in the proposed operation of a space chamber containing spacecraft with loads of cryogenic hydrogen and oxygen on board. Hazards ensuing from leakage, partial spill, or total rupture of tankage were assessed. Mathematical analyses were performed, to compute the effects upon the structure of explosive reactions from released gases under several chamber pressures. An experimental program was run concurrently, to support the analysis. Suggested modifications for the chamber are offered (including costs and schedules for accomplishment), to improve its structural resistance to computed dynamic effects. Recommendations are furnished for fire hazard detection/suppression systems; and recommended operating procedures, to improve safety of operation, are presented. Author

N66-22368*# Martin Co., Denver, Colo.
DESIGN OF AN ONBOARD CHECKOUT SYSTEM. VOLUME I: SUMMARY Final Report
Mar. 1966 30 p
(Contract NAS9-4899)
(NASA-CR-65326; CR-66-12, Vol. I) CFSTI: HC $2.00/MF $0.50 CSCL 22D

The program objectives are outlined for the development of an onboard checkout system which would be applicable to any test and monitoring need. The method of approach and principle assumptions are summarized, and the basic design specifications are discussed. H.S.W.

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N66-21173# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
THE TURBULENT WALL JET ON PLANE AND CURVED SURFACES BENEATH AN EXTERNAL STREAM
Gordon L. Harris Aug. 1965 128 p refs
(VKI-TN-27) CFSTI: HC $4.00/MF $1.00

The flow in an incompressible, two-dimensional turbulent wall jet on a plane surface beneath a moving stream with arbitrary longitudinal pressure gradient has been treated analytically and the resulting formulation programmed for a digital computer. A systematic analysis of the computed flow behavior was carried out which pointed toward the construction of a simplified engineering solution and permitted a deeper insight into the factors influencing the jet behavior. The simplified methods developed have been tentatively extended to the case where the surface over which the jet flows is curved. Author

N66-21199# Yale Univ., New Haven, Conn.
FLOW INSIDE AN AXISYMMETRIC CAVITY INDUCED BY MOVING BOUNDARIES
Jean-Yves Parlange Sep. 1965 21 p refs
(Contract Nonr-609(47))
(Rept.-6; AD-626627) CFSTI: HC $1.00/MF $0.50

The subsonic motion of a gas induced by moving walls inside an axisymmetric cavity is studied. The theory is then compared with experiments; and, the agreement is found to be excellent. Author (TAB)

N66-21218# Aeronautical Research Labs., Melbourne (Australia).
FLOW INVESTIGATION OF TWO-DIMENSIONAL BAFFLE SYSTEMS FOR COMBUSTORS
G. F. Pearce and O. Wilson Apr. 1965 24 p refs
(ARL/ME-266) CFSTI: HC $1.00/MF $0.50

Wind tunnel tests were made to investigate the flow pattern and pressure loss of a number of two-dimensional model combustion chambers whose outer walls correspond to the streamlines for a predetermined potential flow system. For certain streamline shapes it was possible to stabilize the vortex pair situated behind the baffle and at the same time reduce the pressure drop across the baffle, however, the maximum reverse velocity in the recirculating flow was found to be far below the theoretical value for the inviscid flow model. Author

N66-21221# Royal Aircraft Establishment, Farnborough (England). Ministry of Aviation.
ON THE THEORY OF TWO-DIMENSIONAL SELF-SIMILAR TRANSONIC FLOWS [K TEORII AVTOMODEL'NYKH OKOLOZVUKOVYKH TECHENII]
S. V. Fal'kovich and I. A. Chernov Nov. 1965 21 p refs
Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mat. (Kazan), no. 1 (38), 1964 p 125–133
(RAE-LIB-TRANS-1139) CFSTI: HC $1.00/MF $0.50

In this paper certain general properties of self-similar transonic flows are studied. These are illustrated by the example of F. I. Frankl's solution for a sonic flow at a large distance from an arbitrary profile. At the same time it is found that the limiting line which was indicated by L. D. Landau and E. M. Lifshitz belongs to that branch of the solution which may be discarded on physical grounds. Then the remaining branch does not contain limiting lines and determines a continuous flow in all the physical plane. A characteristic of this flow is that the positive x axis is a line of sinks. In order to use this solution to describe a sonic flow at a large distance from the profile, it is necessary to construct an asymptotic shock wave. Author

N66-21222# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France). Faculte des Sciences.
ON THE THEORY OF CORRELATIONS IN JETS
A. Krzywicki Jan. 1966 16 p refs
(TH/130) CFSTI: HC $1.00/MF $0.50

A phenomenological theory of multiple production is formulated in analogy to Kirkwood's theory of liquids. The general idea of this formulation is to derive a sequence of identities relating distribution functions and to convert these identities into a solvable set of nonlinear integral equations with the help of a suitable approximation. The notation used is explained and the integral equations are derived. A particular model of nucleon–nucleon collisions is sketched. M.R.W.

N66-21316# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
ON THE USE OF THE SHOCK LAYER APPROXIMATION IN THE INVERSE HYPERSONIC BLUNT BODY PROBLEM
H. K. Cheng and G. A. Gaitatzes Oct. 1965 67 p refs
(SM-49268)

The usefulness of the shock-layer approximation as a method of attack to the hypersonic blunt body problem is studied. Mainly the inverse problems of axisymmetric inviscid flow of a calorically perfect gas (in which the shock geometry is given) are discussed here. Methods which are consistent with approximations based on a high shock compression ratio (but modified to take into account the contribution of the tangential pressure gradient and some other second order terms) are proposed. Good agreement in body shape and streamlines with other more exact (numerical) solutions is shown not only for specific heat ratios as high as $\gamma=5/3$ and 2, but also for stagnation regions of very blunt configurations, for which the standard shock-layer theory completely fails. Analytic forms of the pressure field, body and streamline geometries are developed for the sonic family shocks (of arbitrary degree of oblateness and eccentricity) in stagnation regions. Author

N66-21327# Chrysler Corp., Huntsville, Ala. Space Div.
PROBLEMS OF LIQUID BEHAVIOR IN WEIGHTLESS ENVIRONMENTS
S. A. Kallis, Jr. 30 Apr. 1965 28 p refs
(HEC-R108; AD-614893) CFSTI: HC $2.00/MF $0.50

Electrolyte, propellant, and foodstuff behavior in free fall is discussed; and some solutions are offered for the positive control of such liquids under zero gravity conditions. Consideration is given to the use of ullage rockets, pneumatic force, and surface tension phenomena for liquid control. Attitude control of propellants by surface tension forces is discussed under the headings of quasi-mechanical, capillary, and molecular methods. M.W.R.

N66-21370# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
[EXPLORATORY FLUID MECHANICS] Final Report
Hans W. Liepmann Dec. 1965 9 p refs
(Contract Nonr-220(21))
(AD-625580) CFSTI: HC $1.00/MF $0.50

A brief resume is given of the more important work conducted over a ten year period in the newer fields of fluid mechanics, and in particular in plasma fluid mechanics and rarefied gas flows. Relative to magnetofluiddynamics, consideration is given to a solution for Stokes flow past a sphere. In the magnetohydrodynamics area, investigations of steadily moving bodies in Hg in the presence of an aligned magnetic field are cited. Relative to rarefied gas flows, mention is given to an investigation of the transition from the Navier-Stokes

regime to free molecular flow. A list of publications and unpublished reports that were compiled during the study is included. C.T.C.

N66-21372# Cincinnati Univ., Ohio.
ASYMPTOTIC METHOD OF SOLUTION OF THE FROZEN DISSOCIATED LAMINAR BOUNDARY LAYER FLOW OVER A FLAT PLATE SURFACE WITH ARBITRARILY DISTRIBUTED CATALYCITY Interim Technical Report, Jun. 1964–Jun. 1965
Ting Y. Li and Phillip S. Kirk Wright-Patterson AFB, Ohio. ARL. Dec. 1965 33 p refs
(Contract AF 33(616)-8453)
(ARL-65-243; AD-628694) CFSTI: HC $2.00/MF $0.50

Meksyn's method of solution of laminar boundary layers is extended to deal with a typical problem of a binary boundary layer with non-similar solution. The present paper deals with the asymptotic method of solution of the frozen dissociated laminar boundary layer flow over a flat plate surface with arbitrarily distributed catalycity. A closed form solution is obtained and has been compared with existing data due to other investigators. Results of the comparison show that the present results are of adequate accuracy. The attractiveness of the present method is in the simplicity of the analysis. Author (TAB)

N66-21379# Michigan Univ., Ann Arbor.
DIGITAL COMPUTER STUDIES OF CONDENSATION IN EXPANDING ONE-COMPONENT FLOWS Interim Report
Kenneth R. Sivier Wright-Patterson AFB, Ohio. ARL. Nov. 1965 66 p refs
(Contracts AF 33(615)-2307; AF 33(657)-8867)
(ARL-65-234; AD-628543) CFSTI: HC $6.60/MF $0.75

The report discusses a digital computer program for calculating the vapor condensation that occurs in expanding, one-component flows. A discussion is presented of modifications made in Griffin's original program (AD-428 303). Emphasis is placed on the reasons for the modifications and their effect on the numerical results. The results of a parametric study (using the computer program) of condensation onset in nitrogen flows are presented and compared with experimental data. Several methods of presenting and correlating condensation onset data are used. One of these produces a remarkable correlation of the numerical results. The comparison between the experimental and numerical data shows that the computer program is able to reproduce satisfactorily the qualitative features of the condensation produced and to yield a relatively good quantitative picture of condensation onset in nitrogen. Author (TAB)

N66-21417# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics.
ON THE FLOW OF AN OSEEN-LIKE FLUID PAST A PARABOLIC CYLINDER
Carl Kaplan Jan. 1966 21 p refs
(Contract AF 49(638)-496)
(AFOSR-SR-66-0001; AD-628811) CFSTI: HC $2.60/MF $0.50

The Navier-Stokes equations for two-dimensional flow are linearized around a dominant uniform stream velocity. The resulting linearized Oseen equations are then regarded as the exact equations of flow of the model fluid. The concept of field modes in fluid mechanics is summarized and then applied to the problem of flow over a parabolic cylinder fixed in an unbounded uniform stream. Author (TAB)

N66-21433# Stevens Inst. of Tech., Hoboken, N. J. Davidson Lab.
HYDROFOIL FLUTTER PHENOMENON AND AIRFOIL FLUTTER THEORY. VOLUME III: SWEEP AND TAPER Final Report
Charles J. Henry and M. Raihan Ali Dec. 1965 66 p refs
(Contract NObs-88365)
(R-1115; AD-626475) CFSTI: HC $3.00/MF $0.75

Measured decay rates and flutter speeds for a two-degree-of-freedom hydrofoil model with sweep or taper do not agree with the decay rates and flutter speeds predicted by two-dimensional strip theory, whereas the measured and predicted frequencies are in agreement. Calculations based on the two-dimensional strip theory show that increasing sweep angle or decreasing taper yields higher flutter speeds as well as higher values of the critical density ratio. It is shown that flutter-speed predictions based on quasi-steady representations of the unsteady hydrodynamic forces are not valid. Author (TAB)

N66-21463# Aeronautical Research Associates of Princeton, Inc., N. J.
ROTATIONAL SOLUTIONS OF THE EULER EQUATIONS Scientific Report
Derek A. Barnes and Roger D. Sullivan Sep. 1965 37 p refs
/ts Rept.-79
(Contract AF 49(638)-1437)
(AFOSR-65-2656; AD-627972) CFSTI: HC $2.00/MF $0.50

Steady state rotational solutions of the Euler equations for an incompressible fluid are discussed, with emphasis on flows characterizing the impingement of a rotational jet upon a plane surface. These solutions are aimed at understanding actual rotational flows undergoing strong interactions, where, to a first approximation, viscous stresses may be ignored after the creation of vorticity. Of particular interest are two axially symmetric flows which have finite velocity profiles at large distances from the impingement plane. One of these has a parabolic profile and represents a flow inside a cylindrical cup of finite radius; the other has a Gaussian profile with streamlines extending to infinity. Analytical expressions and computed values for velocities, velocity gradients, and pressures are given, and a comparisonis made with experimental data obtained at ARAP. Author (TAB)

N66-21487# Hydronautics, Inc., Laurel, Md.
EXPERIMENTAL STUDY OF A CAVITY RUNNING BODY
T. T. Huang Sep. 1965 37 p refs
(Contracts NOw-64-0306-c; NOw-65-0344-c)
(TR-515-1; AD-627352) CFSTI: HC $2.00/MF $0.50

The results of an experimental investigation of a cavity running body are presented. The cavity running body consists of a blunt base nose of a half body of revolution and an afterbody which is completely enclosed by the ventilated cavity. Thus, the afterbody experiences almost no drag and the cavity drag due to the presence of the ventilated cavity becomes a very important component of the drag acting on the cavity running body. Theoretical and experimental results of every component of the drag of the cavity running body are presented and discussed. It is found that the total drag is almost independent of the vapor cavitation number but is highly dependent on the air flow rate to the cavity. The maximum drag reduction is 25 percent. Author (TAB)

N66-21494# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.
MEASUREMENT OF VORTEX SEPARATION. PART II: THREE-DIMENSIONAL CIRCULAR AND ELLIPTIC BODIES

Eric G. Friberg Aug. 1965 88 p refs *Its* Tech. Rept.-115 (Contract N600(19)61720)
(MIT-DSR-5139; AD-628019) CFSTI: HC $3.00/MF $0.75

An experimental investigation of vortex separation about three-dimensional circular and elliptic cones and an ogive cylinder using the hydrogen bubble technique for flow visualization is discussed. Data on the position of the vortex and location of the separation point of the vortex feeding sheet are presented as a function of angle of attack for angles up to thirty degrees. A semi-empirical formula is given to predict the separation position on a circular cone as a function of cone semi-apex angle and angle of attack over the range of angles tested. A semi-empirical formula is also given which predicts the location of separation on an elliptic cone of arbitrary axis-ratio as a function of angle of attack and some equivalent cone semi-apex angle. All data are presumed to be laminar. Author (TAB)

N66-21524# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Aerospace Engineering and Applied Mechanics.
PROPAGATION OF SOUND IN A REACTING GAS MIXTURE NEAR EQUILIBRIUM
Joseph J. Roseman and Vito D. Agosta 1965 33 p refs (Grant AF-AFOSR-86-63)
(PIBAL-796; AFOSR-65-2307; AD-627964) CFSTI: HC $2.00/MF $0.50

The one-dimensional propagation of sound and significance of the two sound speeds (frozen and equilibrium) is examined in detail for the case of a gas mixture at or near equilibrium, consisting of gases which obey the ideal gas law and Dalton's law of partial pressures and which have all their degrees of freedom fully excited. TAB

N66-21575 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE DISCHARGE OF A GAS INTO A LIQUID UNDER CONDITIONS OF WEIGHTLESSNESS
A. S. Povitskiy and L. Ya. Lyubin *In its* Cosmic Res., Vol. 3, No. 5 20 Jan. 1966 p 81-102 refs (See N66-21566 11-30) CFSTI: HC $6.00/MF $1.25

Considered is the process of the discrete discharge of a gas into a liquid. It is demonstrated that the absence of mass forces and even unfavorably directed accelerations can be compensated by the motion of the liquid under specific conditions. The Zhukovskiy method is used to evaluate the interaction between the forming and detached bubbles. Author

N66-21588# Centre National de la Recherche Scientifique, Meudon (France). Laboratoire d'Aerothermique.
STUDY OF CYLINDER WAKES PLACED IN FLOW OF RAREFIED GAS [ETUDE DES SILLAGES DE CYLINDRES PLACES DANS UN ECOULEMENT DE GAZ RAREFIE]
Pierre Trepaud Dec. 1965 112 p In FRENCH *Its* Publ.-256 (Contract DRME-65/34)
(Rept.-65-11) CFSTI: HC $4.00/MF $0.75

Wind tunnel measurements were taken of pressure, temperature, masss, and volume in order to study the wake of a cylindrical body at supersonic speeds and low pressures. A comparison showed good agreement between the experimental results and theoretical calculations based on the hypothesis of free molecular flow. Transl. by D.T.

N66-21592# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany). Wissenschaftlichen Sekretariat.
DVL REPORTS AS OF DECEMBER 31, 1965 [DVL-BERICHTSVERZEICHNIS. STAND 31. DEZEMBER 1965] Bibliography
P. Bruders Jan. 1966 73 p refs In GERMAN
(Rept.-500) CFSTI: HC $3.00/MF $0.75

This bibliography contains a numbered index and brief annotated entries of all publications that were published by the German Institute for Air and Space Flight during the years 1964 and 1965. Appendices list publications by the Research Institute for Jet Propulsion Physics, and from the Aero Science Institute in Munich. G.G.

N66-21603# Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany).
BASE PRESSURE INVESTIGATIONS ON PLANE GAS FLOW OF VARIABLE TEMPERATURES AND SPEEDS [BASISDRUCK-UNTERSUCHUNGEN AN EBENEN GASSTRAHLEN UNTERSCHIEDLICHER TEMPERATUREN UND GESCHWINDIGKEITEN]
K.-D. Emmenthal Nov. 1965 42 p refs In GERMAN; ENGLISH summary
(DLR-FB-65-59) CFSTI: HC $2.00/MF $0.50

A measuring instrumentation is described for the determination of the base pressure and the dynamic pressure isobars p_{stau}= 0. With boattail and rectangular and circular basis of the dividing wall, base pressure conditions and dynamic pressure isobars for different flow parameters are measured of transonic hot gas flow and supersonic cold air flow. The measurements show that at the given flow conditions, maximum underpressure values and -zones occur with rectangular basis of the dividing wall. If minimum underpressures and small zones of underpressure are desired, a boattail type has to be chosen. Relatively large zones of underpressure at low underpressures occur at a circular basis of the dividing wall. Author

N66-21605# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Berlin (West Germany).
ON THE GROWTH OF DISTURBANCES IN SEPARATED LAMINAR BOUNDARY LAYERS [UBER DIE ANFACHUNG VON STORUNGEN IN ABGELOSTEN LAMINAREN GRENZSCHICHTEN]
P. Freymuth Jan. 1966 70 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-02; DVL-451) CFSTI: HC $3.00/MF $0.75

This paper deals with the growth of disturbances in separated laminar boundary layers as a function of the hydrodynamic characteristic numbers for high Reynolds numbers. The experiments show that only the Strouhal number has an effect on the spatially growing disturbances. Thus the basic equations of the process become simple. The theoretical results are in good agreement with the experiments. Author

N66-21699*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYTICAL METHOD FOR DETERMINING FLOTATION STABILITY CHARACTERISTICS OF A RIGHT-CIRCULAR-CONIC FRUSTUM
Robert L. Wright, John F. Newcomb, James L. Dillon, and Julia M. Willman Washington, NASA, Apr. 1966 37 p ref (NASA-TN-D-3310) CFSTI: HC $0.50/MF $0.50 CSCL 20D

An analytical method has been developed for determining the flotation stability characteristics of a right-circular-conic frustum with the small face submerged. General nondimensional equations for the center-of-buoyancy location, metacentric height, righting moment arm, and the special case of the rearmost location of the center of gravity were derived in which the geometry, the mass, and the angle of inclination of the floating body with respect to the water line are the only variables. The equations are limited by the inclination angle for which any portion of the base becomes submerged. Numerical results were computed to provide the designer a convenient method for determining the desired flotation stability parameters. Several examples are presented as guidelines in the use of the method. Author

N66-21737# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Aachen (West Germany). Institut für Theoretische Gasdynamik.

AN ANALYTIC CALCULATION OF CHARACTERISTIC SURFACES FOR FLOW PROBLEMS [ANALYTISCHE BERECHUNG VON CHARAKTERISTIKENFLACHEN BEI STROMUNGSVORGANGEN]

K. Oswatitsch Dec. 1965 50 p refs In GERMAN; ENGLISH summary

(DLR-FB-65-62) CFSTI: HC $2.00/MF $0.50

Through the introduction of characteristic surfaces as independent variables, some progress has recently been made in the analytic solution of hyperbolic small perturbation flow problems, e. g. the calculation of supersonic flow past slender bodies or that of unsteady wave propagation, and it was thus possible to obtain solutions to certain open questions. An essential partial problem of the new theory consists in calculating the characteristic surfaces in flow space. This is dealt with in the present paper in the case of three independent variables, and is explained by means of steady three-dimensional supersonic flow as well as by means of wave propagation with two space coordinates. In accordance with the general mathematical theory, the bi-characteristics are here of special significance. Author

N66-21738# Technische Hogeschool, Eindhoven (Netherlands).

A THEORETICAL STUDY ON TWO PHASE FLOW CHARACTERISTICS

F. v. d. Walle, C. L. Spigt, H. J. Lamein, and M. Bogaardt Brussels, EURATOM, Jan. 1966 23 p refs Presented at the Symp. on Two-Phase Flow, Exeter, England, 20–23 Jun. 1965 Sponsored by EURATOM/VS Agreement for cooperation

(Contract EURATOM-030-64-1 TEEN)

(EUR-2335.e; EURAEC-1360) CFSTI: HC $1.00/MF $0.50

In this paper a theoretical model describing the heat transfer and fluid flow characteristics in vertical boiling channels is derived from first principles. In general flow equations, that is to say the continuity, momentum, energy equation and the equation for diffusion and growth of bubbles have been formulated for the unsteady case. The theoretical model ascribes the increase in frictional pressure drop and heat transfer in two phase flow as compared to single phase flow to an increased turbulence level due to the relative movement of the vapor bubbles with respect to their surroundings. The formulation of the equations results in a set of simultaneous partial differential equations for the various unknowns as a function of the space and time coordinates. After the introduction of dimensionless parameters it is found that 8 similarity parameters govern the solutions of the exact equations. So far the equations for the steady state have been elaborated further. By the introduction of prescribed radial distribution for the velocity, temperature and bubble density the set of equations has been reduced to a set of ordinary differential equations. For the purpose of a systematic analysis a digital computer program has been written. Results of calculations are given for an annular geometry test section as a function of the conditions at the inlet of the riser section. Author

N66-21740# British Hydromechanics Research Association, Harlow (England).

THE USE OF A TWO-DIMENSIONAL VORTEX MODEL FOR CALCULATING THE FLUCTUATING FORCES ON AN AXIAL FLOW PUMP

Diana M. Copley Apr. 1963 16 p ref

(RR-769) CFSTI: HC $1.00/MF $0.50

In a previous report a method of estimating the magnitude of the fluctuating forces and velocities inside a centrifugal pump was explained. The present report shows how the same approach can be applied to an axial flow pump and outlines an investigation into the working of a particular pump which was known to vibrate during operation. The effect of the flow disturbance caused by a pipe bend upstream of the impeller is considered, and it is shown that an uneven distribution of flow can cause a considerable sideways force on the impeller. Author

N66-21755# TRW Systems, Redondo Beach, Calif. Aerophysics Dept.

ARPA WIND TUNNEL First Quarterly Progress Report

Leslie A. Hromas Jan. 1966 3 p

(Contract AF 04(694)-638)

(TRW-6454-6014-TO-000; AD-627810) CFSTI: HC $1.00/MF $0.50

The purpose of the study is to make detailed flow measurements in the near wake of a slender two-dimensional body having base fluid injection. TAB

N66-21772*# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering.

CONTINUUM FEEDBACK CONTROL OF A RAYLEIGH-TAYLOR TYPE INSTABILITY

James R. Melcher and Everett Paul Warren [1965] 49 p refs

(Grant NsG-368)

(NASA-CR-71408) CFSTI: HC $2.00/MF $0.50 CSCL 20D

The electrohydrodynamics of a highly conducting interface stressed by a perpendicular electric field and attached (by surface tension) to a rigid circular wall are described in terms of a set of normal modes which satisfy four boundary conditions. The interface can be unstable either because of gravity (a heavy fluid on top of a light fluid) or because of the electric field. The experimental eigenfrequencies, eigenfunctions and conditions for instability are compared to the theory. These modes are then used to describe the dynamics when the interface displacement is detected and a proportionate potential is fed back to the segmented electrode which imposed the quiescent electric field. Electronic means for detecting interface disturbances are described together with the relationship between the sampling scheme and possible overstability. A comparison of theory and experiment is made for the eigenfrequencies with feedback, and conditions for significant improvement in stability are given. Author

N66-21779*# Brown Engineering Co., Inc., Huntsville, Ala. Scientific Research Labs.
THE APPLICATION OF ONE-DIMENSIONAL ANALYSIS TO THRUST AUGMENTATION FOR THERMALLY PERFECT BUT CALORICALLY IMPERFECT GASES
F. W. Geiger Sep. 1963 23 p refs
(Contract NAS8-5289)
(NASA-CR-71540; R-69) CFSTI: HC $1.00/MF $0.50 CSCL 20D

One-dimensional analysis is applied to the problem of determining the flow parameters at the exit of a rocket thrust augmentor, given the chemical compositions of primary, secondary, and exit, and the flow parameters at the entrance (primary and secondary). The effect of burning auxiliary fuel (liquid) in the secondary is included. With the exception of the static pressure ratios and mass flow ratios, the usual flow parameters and parameter ratios such as Mach number, specific heat ratio, total temperature and total pressure do not appear explicitly in the equations. These equations must generally be solved for each specific separate problem. Author

N66-21807*# Purdue Univ., Lafayette, Ind. School of Aeronautics, Astronautics and Engineering Sciences.
STUDY OF RECIRCULATING GAS FLOW FIELDS IN THE BASE REGION OF SATURN-CLASS VEHICLES Quarterly Progress Report, 1 Aug.-31 Oct. 1965
Richard F. Hoglund [1965] 28 p refs
(Contract NAS8-11485)
(NASA-CR-71530) CFSTI: HC $2.00/MF $0.50 CSCL 01A

The mathematical correspondence between low speed and high speed turbulent boundary layers which was developed by Coles and extended by Crocco is extended to multi-specie and chemically reacting flows. It is found that the Prandtl and Lewis number transformations are coupled, except in the singular case where all such numbers are unity. A simple boundary layer situation is examined to determine the quantitative nature of the coupling. It is concluded that the Coles-Crocco transformation scheme generally requires physically unrealistic values of transport properties when chemistry is considered. Author

N66-21830# General Applied Science Labs., Inc., Westbury, N. Y.
COMPUTER PROGRAMS FOR A REACTIVE TURBULENT BOUNDARY LAYER—AIR VERSION
B. Bellow 15 Sep. 1965 88 p refs
(Contract ARPA SD-149; ARPA Order 396)
(TR-549; AD-627474) CFSTI: HC $3.00/MF $0.75

Computer programs for the calculation of properties within a reactive compressible turbulent air boundary layer on a flat plate are described. The pressure is constant throughout the boundary layer. The partial differential equations for energy and species mass conservation are solved with arbitrary initial conditions by a finite difference technique. A variable wall temperature boundary condition may be used. The boundary conditions at the edge of the boundary layer are constant with respect to the axial coordinate. The partial differential equations, which describe a two-dimensional diffusing flow, may be coupled to a system of equations describing a one-dimensional finite-rate air chemically reacting flow, and hence may be used in the numerical treatment of the two-dimensional reacting boundary layer. Author (TAB)

N66-21831# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
A METHOD OF SERIES TRUNCATION APPLIED TO SOME PROBLEMS IN FLUID MECHANICS
Milton van Dyke Oct. 1965 22 p refs Presented at the 7th Symp. on Advanced Probl. and Methods in Fluid Dyn., Jurata, Poland, Sep. 1965
(Contract AF 49(638)-1274)
(SUDAER-247; AFOSR-65-2014; AD-627655) CFSTI: HC $1.00/MF $0.50

Topics include thin layers: the blunt body problem; changes of variable: an accurate blunt-body solution; Thick layers: viscous flow past circle and parabola; local truncations: viscous flow past a flat plate. TAB

N66-21843# RAND Corp., Santa Monica, Calif.
NUMERICAL CALCULATIONS OF THE FLOW AROUND A FLARED CONE [CHISLENNII RASCHET OBTAKANIYA STUPENCHATOVO KONUSA]
G. S. Roslyakov and N. V. Drozdov Dec. 1965 22 p refs Transl. into ENGLISH from the publ. "Chislenniye Metodi v Gazovoi Dinamike, Sbornik Rabot Vichislitel Novo Tsentra Mgu. II" Moscow Univ. Press, 1963 p 61-74
(LT-65-19; TT66-60490; AD-627881) CFSTI: HC $1.00/MF $0.50

A method is presented for the numerical computation of the flow near a sharp nosed right circular cone-flare immersed in a supersonic ideal gas flow. It is assumed that the flow is uniform, the free-stream velocity vector is parallel to the axis of the body, and conditions are such that the conical nose shock is attached. It is further assumed that the flare (second cone) angle is greater than the cone angle, so that a curvilinear shock originating from the intersection of the cone-flare is generated. At some distance from the body both shocks intersect. In the region bounded by the shocks and the cone, the flow is conical and solutions of conic flows are given in tabular form. Beyond the curvilinear shock the flow becomes vortical and the calculating of it presents many difficulties. The vortical flow field, with the exception of the neighborhood of cone-flare intersection, is calculated by the method of characteristics. For the determination of the flow field near the intersection the results of an approximate theory are utilized. Author (TAB)

N66-21855# Aktiebolaget Atomenergi, Stockholm (Sweden).
MEASUREMENTS OF HYDRODYNAMIC INSTABILITIES, FLOW OSCILLATIONS AND BURNOUT IN A NATURAL CIRCULATION LOOP
Kurt M. Becker, R. P. Mathisen, O. Eklind, and B. Norman 1964 41 p refs
(AE-131) CFSTI: HC $2.00/MF $0.50

The hydrodynamic stability and the burnout conditions for flow of boiling water have been studied in a natural circulation loop in the pressure range from 10 to 70 atg. The test section was a round duct of 20 mm inner diameter and 4890 mm heated length. The experimental results showed that within the ranges tested the stability of the flow increases with increasing pressure, increasing throttling before the test section, but decreases with increasing inlet sub-cooling and increasing throttling after the test section. Author

N66-21869# Aktiebolaget Atomenergi, Stockholm (Sweden).
HYDRODYNAMIC INSTABILITY AND DYNAMIC BURNOUT IN NATURAL CIRCULATION TWO-PHASE FLOW: AN EXPERIMENTAL AND THEORETICAL STUDY
K. M. Becker, S. Jahnberg, I. Haga, P. T. Hansson, and R. P. Mathisen 1964 46 p refs
(AE-156) CFSTI: HC $2.00/MF $0.50

A theoretical model for predicting the threshold of instability for two-phase flow in a natural circulation loop is presented. The model calculates the flow transient caused by a step disturbance of the heat input, and is based upon the conservation laws of mass, momentum and energy in one-dimensional form. Empirical correlations are used in the model for estimating the void fractions and the two-phase flow pressure drops. The equations are solved numerically in a finite difference approximation coded for a digital computer. An experimental study of the hydrodynamic instability and dynamic burnout in two-phase flow was performed in a natural circulation loop in the pressure range from 10 to 70 atg. The test sections were round ducts of 20, 30 and 36 mm inner diameter and 4890 mm heated length. The experimental results showed that within the ranges tested, the stability of the flow increases with increasing pressure and increasing throttling before the test section, but decreases with increasing inlet subcooling and increasing throttling after the test section. Comparing the natural circulation burnout steam qualities with corresponding forced circulation data showed that the former data were low by a factor up to 2.5. However, by applying inlet throttling of the flow the burnout values approached and finally coincided with the forced circulation data. The application of the experimental and theoretical results on the assessment of boiling heavy water reactor design is discussed. Author

N66-21887# California Inst. of Tech., Pasadena. Hydrodynamics Lab.
PARAMETERS AFFECTING CAVITATION AND SOME NEW METHODS FOR THEIR STUDY Final Report
Albert T. Ellis Oct. 1965 48 p refs
(Contract Nonr-220(44))
(E-115.1; AD-627925) CFSTI: HC $2.00/MF $0.50

New experimental observations are presented which support the high speed jet mechanism of cavitation damage. A general discussion of the basic hydrodynamic theory involved is given and the importance of certain parameters on damage are pointed out. New techniques for studying the collapse of single cavities are described and the concept and development of a high speed photographic system using a ruby laser is outlined. Magnifications of up to fifty times at picture repetition rates as high as 1,600,000 per second and exposure times of 20 billionths of a second have been achieved. Author (TAB)

N66-21888# Sensory Systems Lab., Tucson, Ariz.
EXPERIMENTAL STUDIES ON TARGET DETECTION, EVALUATION AND INTERCEPTION BY ECHOLOCATING BATS Final Report, 1 May 1964–20 Feb. 1965
Frederic A. Webster and Oliver G. Brazier Wright-Patterson AFB, Ohio, AMRL, Nov. 1965 144 p refs
(Contract AF 33(615)-1142)
(AMRL-TR-65-172; AD-628055) CFSTI: HC $4.00/MF $0.75

The echolocation techniques of bats provide functioning models with useful attributes: versatility of application, ultraminiaturization of components, and processing methods capable of dealing rapidly and reliably with complex echo indications despite the inherent slowness of unit neural components. Present experiments, carried out on captive bats trained to catch natural and artificial targets projected into their flight paths, have quantified certain basic measures of performance. Spheres as small as 1/16 inch diameter were detected and localized at two or more feet, with resulting interceptions being accomplished in 1/4 second. Final localization accuracies of 1 cubic centimeter were sometimes achieved, even when resolution of up to 16 nearby targets was required. Massive or complex clutter backgrounds tended to reduce interception performance at short target-to-clutter distances, but some interceptions were accurately completed during actual contact with natural twigs or foliage; or when pursuit paths had to be radically adapted to background configurations. Interception scores for food targets sometimes exceeded 99% while like-size negative targets of a different shape could be correctly discriminated roughly 95% of the time. Author (TAB)

N66-21910# General Electric Co., Philadelphia, Pa. Missile and Space Div.
NONSIMILAR MIXING OF CHEMICALLY REACTING STREAMS
H. G. Lew Jan. 1966 50 p refs *Its* Tech. Inform. Ser.
(Contract AF 04(694)-667)
(R66SD5; AD-628629) CFSTI: HC $2.00/MF $0.50

The study of the laminar mixing of chemically reacting streams is presented with emphasis on the nonsimilar and nonequilibrium aspect of the problem. A mixture of dissociated and ionized air species with seven components and eleven reaction models (N, O, N_2, O_2, NO, NO^+, e^-) is considered. Results show the importance of nonequilibrium production of electrons in the mixing region, and that the shear layer will take many shear layer thicknesses to reach equilibrium. The numerical example shows the rapid increase of atomic species and electrons along the dividing streamline due to diffusion from the top layers. Author (TAB)

N66-21916# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
IRROTATIONAL AND ROTATIONAL SOLITARY WAVES IN A CHANNEL WITH ARBITRARY CROSS SECTION
Arthur S. Peters Jan. 1966 62 p refs
(Contract Nonr-285(55))
(IMM-345; AD-627433) CFSTI: HC $3.00/MF $0.75

This report is an investigation of irrotational and rotational solitary waves in a liquid of constant density contained in a channel with arbitrary cross section. The three-dimensional aspects of these waves are studied in some detail and they are compared with the properties of the classicial two-dimensional solitary wave. Author (TAB)

N66-21952# Massachusetts Inst. of Tech., Cambridge. Div. of Sponsored Research.
THE MOMENTUM FLUX IN TWO-PHASE FLOW Technical Report No. 4547-38
Gerry B. Andeen Peter Griffith Oct. 1965 141 p refs
(Contract AT(30-1)-3496)
(MIT-3496-1) CFSTI: HC $4.00/MF $1.00

The average momentum flux at a section of a pipe with two-phase upflow was measured by the impulse technique. Steam-water and air-water mixtures were tested in one-inch and one-half inch nominal pipes. Homogeneous velocities ranging from 150 to 1200 ft/sec and qualities from 5 to 85% were tested. The results were compared to the results of models currently in practice for predicting pressure drop and critical flow. The influence of the void fraction, the velocity profile, phase distribution, and fluctuations upon the momentum flux are discussed. Author (NSA)

N66-22054# California Univ., Berkeley. Lawrence Radiation Lab.
GAS ABSORPTION BY DROPS TRAVELING ON A VERTICAL WIRE

S. M. Rajan (M.S. Thesis) Jun. 1965 68 p refs
(Contract W-7405-ENG-48)
(UCRL-16047) CFSTI: HC $3.00/MF $0.75

Liquid phase-controlling mass transfer was studied for a gas–oil system. Pure CO_2 is absorbed in white oil traveling on a wire in the form of drops interconnected by a thin film. Circulating tori within the drops moving down with the wave velocity were observed. The effects of drop size, flow rate, diffusivity, and column length on the mass transfer were examined. The results were plotted by a method suggested in the literature for mass transfer to circulating spherical drops. A model is presented to get a handle on a correlation to coalesce all the obtained data. The results indicate that there are three stages of mass transfer. First, the gas is transferred to the film and the drop; next the gas in the film is transferred to the circulating tori; finally, the tori carry the dissolved gas out of the column. Any correlation would have to include all three of these contributions. The proposed model coalesces the obtained results to within experimental accuracy.
Author (NSA)

N66-22072# Sandia Corp., Livermore, Calif.
THEORY OF ONE-DIMENSIONAL SHOCK WAVE PROPAGATION
G. T. Taoka Jun. 1965 49 p refs
(Contract AT(29-1) -789)
(SCL-DR-65-75) CFSTI: HC $2.00/MF $0.50

The general theory of the one-dimensional propagation of shock waves in a continuous medium is presented. Initially, the theory is developed for the purely hydrodynamic case. Later, the effects of elastic-plastic flow are included. The finite difference form of the fundamental partial differential equations is also presented.
Author (NSA)

N66-22095# Pittsburgh Univ., Pa.
STABILITY ANALYSIS FOR A STEAM GENERATOR
Michael A. Pulick (M.S. Thesis) 1965 77 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-T-1652) CFSTI: HC $3.00/MF $0.75

A digital-computer analysis designed to predict the presence of oscillations in downcomer flow, steam flow, or water level for a steam generator is presented. In addition, the analysis solves for the steady-state internal conditions—downcomer flow, pressure drops, and enthalpies throughout the steam generator. The analysis is based on linearizing the transient conservation equations. Linear feedback control theory is used to develop an open loop transfer function from the resulting linearized equations. The stability of the open loop transfer functions, which represents the stability of a small perturbation about a steady-state operating condition, is examined by a Nyquist stability criterion. Results from a sample test problem indicate excellent agreement between predictions of the analysis and experiment.
Author (NSA)

N66-22126# Dartmouth Coll., Hanover, N. H. Thayer School of Engineering.
TWO-PHASE FLOW AND BOILING HEAT TRANSFER Quarterly Progress Report, Jan.–Mar. 1965
G. B. Wallis, J. M. Turner, P. E. Meyer, and D. E. Runge [1965] 21 p refs
(Contract AT(30-1)-3114)
(NYO-3114-7; EURREC-1414) CFSTI: HC $1.00/MF $0.50

Work on the annular flow regime has continued. General equations were derived relating shear stress and velocity profiles in both horizontal and vertical flow. A simple model was developed which gives a pressure drop correlation very close to Martinelli's prediction and also predicts countercurrent flow flooding in vertical pipes. Comparison of various analytical techniques for studying drop-annual flow seems to show that as long as there is any noticeable entrainment the homogeneous flow model gives good correlation of experimental data. Various fluids and tube sizes were used to measure the rise velocity of slug flow bubbles in inclined tubes.
Author (NSA)

N66-22264*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN EXPERIMENTAL INVESTIGATION OF THE DYNAMIC BEHAVIOR OF THE LIQUID-VAPOR INTERFACE UNDER ADVERSE LOW-GRAVITATIONAL CONDITIONS
William J. Masica and Jack A. Salzman Washington, NASA, 1965 15 p refs
(NASA-TM-X-52095) CFSTI: HC $1.00/MF $0.50 CSCL 20D

Experimental investigations are being conducted on the behavior of the liquid-vapor interface under the influence of low acceleration environments. This paper presents the results of several phases of these investigations. Discussions are included on the stability characteristics of the interface, the quantitative description of the interface motion, and the mechanism of reorientation or collection in response to adverse constant translational accelerations. The studies concluded that the motion of the liquid-vapor interface in response to low acceleration-induced forces can be predicted. However, accurate time estimates of complete propellant reorientation or collection cannot be made because of the geysering phenomena. Baffling techniques designed to obtain collection can be effective, but they result in considerable propellant agitation with possible concurrent vehicle control problems.
R.N.A.

N66-22266*# TRW, Inc., Cleveland, Ohio. Accessories Div.
THREE-DIMENSIONAL ANALYSIS OF INDUCER FLUID FLOW
Paul Cooper and Heinrich B. Bosch 11 Feb. 1966 245 p refs
(Contract NAS3-2573)
(NASA-CR-54836; TRW-ER-6873A) CFSTI: HC $6.00/MF $1.50 CSCL 20D

Analytical studies were conducted to provide means for improving the design of inducers for high-speed, high-flow rocket engine pumps. Exact and approximate methods are presented for obtaining three-dimensional solutions to turbomachine flows with losses and vaporization, and results are presented for two sample inducers. The exact method solves four non-linear differential equations of motion simultaneously by finite-difference and relaxation techniques that employ a "total residual" concept. Conclusions on inducer performance and design are made on the basis of several approximate solutions of both incompressible and two-phase flows, together with analysis of fluid thermal and scale effects. Fortran IV listings of the analysis computer programs are presented.
Author

N66-22340* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OPTICAL INTEGRATION OVER CORRELATION AREAS IN TURBULENT FLOWS
F. R. Krause and M. J. Fisher (IIT Res. Inst.) *In its* Aero-Astrodyn. Res. Rev. No. 3 15 Oct. 1965 p 85–87 refs (See N66-22329 11-34) CFSTI: HC $4.00/MF $1.00

Statistical analyses of turbulent fluctuations are needed to provide inputs for dynamical and structural response calculations. Previous experimental investigations of area-integrates correlation functions are limited because they were based on point measurements with standard solid probes like hot wires and dynamic pressure transducers. In this paper the use of the integrating features of optical beams for a one shot estimate of area integrated correlation functions is discussed. Author

N66-22383# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHYSICS OF SHOCK WAVES AND HIGH-TEMPERATURE HYDRODYNAMIC PHENOMENA
Ya. B. Zel'dovich and Yu. P. Rayzer 30 Sep. 1965 1095 p refs Transl. into ENGLISH of the book "Fizika Udarnykh Voln i Vysokotemperaturnykh Gidrodinamicheskikh Yavleniy" Moscow, Gos. Izd. Fiz.-Mat. Lit., 1963 p 1–632
(FTD-MT-64-514; AD-622356) CFSTI: HC $13.95/MF $4.00

Contents: Elements of gas dynamics and classical theory of shock waves; thermal radiation and radiant heat exchange in a medium; thermodynamic properties of gases at high temperatures; shock tubes; absorption and emission of radiation in gases at high temperatures; speed of relaxation processes in gases; structure of front of shock waves in gases; physicochemical kinetics in hydrodynamic processes; light phenomena in shock waves and during strong explosion in air; thermal waves; shock waves in solids; certain self-similar processes in gas dynamics. TAB

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N66-21133# Weapons Research Establishment, Salisbury (Austrlia).
IONOSPHERIC DATA FOR JUNE 1965 FROM SALISBURY, SOUTH AUSTRALIA
Sep. 1965 37 p
(WRE-CPD-1465/6(S)) CFSTI: HC $2.00/MF $0.50

Tables of the hourly values of the customary ionospheric parameters are given for the station at Salisbury for June 1965. Author

N66-21186# Air Force Cambridge Research Labs., Bedford, Mass.
GROUP PROPAGATION IN THE WHISTLER-HYDROMAGNETIC EXTENSION OF MAGNETOIONIC THEORY
Gideon Kantor and Frank A. Pivarunas Nov. 1965 32 p refs *Its* Environ. Res. Papers no. 153
(AFCRL-65-811; AD-626166) CFSTI: HC $2.00/MF $0.50

An exact formulation is presented of the propagation of wave packets at whistler and hydromagnetic frequencies in a collision-free, electrically-neutral mixture of electrons and ions of one type. Expressions are derived for μ, the group refractive index, and for α, the angle between the direction of propagation of the wave packets and the wave normal. Computed values of μ and α for the electron-to-proton mass ratio are plotted as a function of X, the square of the ratio of electron plasma frequency to wave frequency. The plots for high X values are applicable to whistler and hydromagnetic wave propagation in the magnetosphere. Author (TAB)

N66-21212# Joint Publications Research Service, Washington, D. C.
DENSITY VARIATIONS IN THE FREE ATMOSPHERE OVER SOME REGIONS OF THE NORTHERN HEMISPHERE
L. M. Krylova and O. B. Mertsalova 18 Mar. 1966 25 p refs Transl. into ENGLISH from Tr. Nauchno-Issledovatel'skii Inst. Aeroklimatologii (Leningrad), no. 30, 1965 p 119–132
(JPRS-34614; TT-66-31053) CFSTI: $1.00

This paper gives the method for computing the mean square deviation of density on the basis of observational data on pressure and temperature. The authors give the geographical distribution of the mean square deviation and the coefficient of density variability for the winter and summer seasons over some regions of the northern hemisphere in the troposphere and lower stratosphere. Author

N66-21239# United Research Services, Burlingame, Calif.
STUDY OF THE DYNAMIC STRESS–STRAIN AND WAVE-PROPAGATION CHARACTERISTICS OF SOILS. REPORT I: CONCEPTS, EQUIPMENT, AND TECHNIQUES FOR THE STUDY OF THE DYNAMIC BEHAVIOR OF SOILS
J. V. Zaccor, H. G. Mason, and D. F. Walter Nov. 1964 150 p refs
(Contract DA-22-079-ENG-373)
(Rept.-3-91; AD-453420)

This report summarizes the concepts used at United Research Services Corporation (URS) in the development of unique equipment and techniques necessary for a laboratory study of dynamic soil response to propagating finite-amplitude waves as that study relates to underground protective construction. The general approach, physical concepts, and methods employed in the actual development of the equipment are discussed. The equipment and its capabilities are described. A brief summary of concurrent reports that describe results of studies of response in granular media is presented. The summary indicates that the significant parameters have been correctly identified from theoretical mechanics and suitably measured, since results demonstrate relationships between stress–strain behavior and propagating waves in laboratory devices. The report also summarizes the broad range of protective construction problems which lend themselves to study in this equipment. These include such studies as the effects of reflection phenomena, the effects of layered media, soil-structure interaction in a high-stress field, and the evaluation of disturbances in free-field conditions caused by the presence of a gauge. The latter is shown to be possible by virtue of the ability to measure soil response without placing a gauge in the soil or attaching one to the sample. Author

N66-21259# Texas A&M Univ., College Station.
SPACE VARIATIONS IN AXIS HEIGHT OF THE JET STREAM CORE
Cooke Hearon Leutwyler (M.S. Thesis) Aug. 1965 48 p refs
(Contract AF 33(608)-1284)
(AD-624665) CFSTI: HC $2.00/MF $0.50

Conventional upper air data and analyses for a six-month period were examined for the variations in height that occur along the jet stream axis. From that period, 451 jet streams were divided into eight different classes according to the flow

patterns in the jet streams. There was sufficient data in seven of the classes to derive mean curves, the standard deviation from the curves, and the extreme deviation for the class. The mean curves derived represent the first comprehensive group of models of the space variations in axis height of the jet stream core. The theoretical relationship between the upward or downward slope of the jet stream axis and the temperature field in the vicinity of the axis is discussed. A specific jet stream situation is examined to show the general validity of the theoretical considerations. Author (TAB)

N66-21269# Weapons Research Establishment, Salisbury (Australia).
IONOSPHERIC DATA FOR JUNE 1965 FROM WOOMERA, SOUTH AUSTRALIA
Aug. 1965 32 p
(WRE-CPD-1965/6(W)) CFSTI: HC $2.00/MF $0.50

Tables of the hourly values of the customary ionospheric parameters are given, along with the ionosonde operating characteristics. These latter include the following: frequency range, 0.7 to 25.0 Mc/s; sweep time, 50 seconds per band with 10 second intervals between bands; pulse repetition frequency, 50 c/s; pulse length, 100 to 300 microseconds; peak pulse power, 1 kW; and height range, 100 to 2000 km. D.T.

N66-21337# Air Force Cambridge Research Labs., Bedford, Mass. Terrestrial Sciences Lab.
BIBLIOGRAPHY OF EXPERIMENTAL ROCK DEFORMATION, SECOND EDITION
R. E. Riecker, H. L. Cook, and D. L. Pendleton Oct. 1965 114 p refs *Its* Spec. Rept.-35
(AFCRL-65-740; AD-627002) CFSTI: HC $4.00/MF $0.75

A bibliography of over 1000 rock deformation research articles published in scientific journals and books is presented with both subject and author entries. The cross-referenced subject listing include the following major categories: Apparatus, Brittle Behavior, Calcite, Calibration, Conductivity, Creep, Dislocations, Dolomite, Ductile Behavior, Elastic Behavior and Elastic Constants, Fabric, Friction, General, Ice, Marble, Olivine, Phase Studies, Quartz, Recrystallization, Resistance, Safety, Sedimentary Rocks, Seismic Velocities, Shear, Shock, Strain Rate, Surveys, Viscosity, X-ray. Author (TAB)

N66-21393# Brown (D.) Associates, Inc., Eau Gallie, Fla.
SIMULATIONS OF GEODETIC POSITIONING BY THE METHOD OF CONTINUOUS TRACES Final Report, Apr. 1965–Jan. 1966
Duane C. Brown 7 Jan. 1966 43 p refs
(Contract AF 19(628)-5078)
(AFCRL-66-70; AD-628184) CFSTI: HC $4.60/MF $0.50

The method of continuous traces allows the geodetic positions to be recovered from uninterrupted optical observations of sun-illuminated passive satellites. The observational material for the method consists of sets of photographic plates on which unbroken traces of satellites are recorded against the stellar background. A series of numerical simulations designed to establish quantitatively its theoretical potential are presented. It is found that with suitable and altogether practical geometry, the method of continuous traces is sharply determinate and can recover geodetic positions to extremely high accuracies. Accordingly, it is recommended that a comprehensive computer program be developed to permit full-scale operational testing of the method with actual data. Should the method of continuous traces be found in practice to approach its theoretical expectations, it will clearly have far reaching implications in geodetic photogrammetry. Author (TAB)

N66-21410# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CENTRIFUGAL SEALING OF A ROTATING SHAFT
M. A. Razran and B. S. Troyanker 7 Oct. 1965 10 p Transl. into ENGLISH from the Russian Patent No. 165824 (Appl. No. 846604/25-8, 9 Jul. 1963) 2 p
(FTD-TT-65-1131/1+2+4; AD-623210)

The object of the invention is the centrifugal sealing of a rotating shaft, for instance, of a centrifugal pump. To prevent overflow of the medium along the rotating shaft and to create self-sealing, elastic disks with edges bent in the direction of the medium of increased pressure are installed in the immobile sleeve fastened in the housing of the pump which are placed between the hard washers and fastened onto the rotating shaft. Author (TAB)

N66-21422# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
THE MEASUREMENT OF PHASE AND AMPLITUDE RADIO WAVE INTERACTION AT UNIVERSITY PARK, PENNSYLVANIA, JULY–AUGUST–SEPTEMBER, 1965
Anthony J. Ferraro and Hai Sup Lee 12 Jan. 1966 55 p refs *Its* Sci. Rept.-261
(Contract AF 19(628)-4014; Grant NSF GP-846)
(AFCRL-66-19; AD-628084) CFSTI: HC $3.00/MF $0.50

The objective of the present work is to study the properties of ionospheric D-region using radio wave interaction effect which is also commonly known as Luxembourg effect. The present technique closely follows that developed by Fejer (1955) for radio wave amplitude interaction experiment. However, the technique of measurement as well as the theory of radio wave interaction have been extended and generalized at the Ionosphere Research Laboratory by the introduction of complex coefficient of interaction T, to embody the effect of interaction on both the amplitude and the phase of radio waves. TAB

N66-21430# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
A STUDY OF THE RESONANCE EFFECTS DUE TO THE EARTH'S POTENTIAL FUNCTION
S. M. Yionoulis Jul. 1965 29 p refs
(Contract NOw-62-0604-c)
(TG-708; AD-621279) CFSTI: HC $1.00/MF $0.50

This paper presents a detailed description of the resonance effects due to the earth's potential. Equations are presented which enable the reader to determine which harmonics in the geopotential expansion will contain near-resonant contributions for a given satellite orbit. Coefficients associated with the harmonics of degree and order (n,m)=(13, 13), (14, 14), and (15, 14) are found. Author (TAB)

N66-21486# Army Foreign Science and Technology Center, Washington, D. C.
ESSENCE OF CARTOGRAPHIC REPRESENTATION AND THE PROSPECTS FOR ITS DEVELOPMENT
A. S. Vasmut and A. B. Rogov Dec. 1965 12 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 6, Jun. 1964 p 53–60
(FSTC-381-T65-678; AD-627918) CFSTI: HC $1.00/MF $0.50

A general discussion is presented of the uses of cartography in science and industry, and the lines along which new developments are proceeding. Advances in microfilming and the use of smaller printing types are mentioned along with possibilities of luminescent notation and improved reproduction methods. M.W.R.

N66-21497# DECO Electronics, Inc., Cambridge, Mass.
DEEP EARTH CONDUCTIVITY MEASUREMENT TECHNIQUES
J. J. Jacobson and E. L. Maxwell Jan. 1966 66 p refs
(Contract Nonr-3387(00))
(Rept.-30-P-10; AD-627665) CFSTI: HC $3.00/MF $0.75

Since 1960 DECO Electronics, Inc., has obtained considerable experience in the technique of measuring the electrical conductivity of the earth. This report deals specifically with the four-terminal array methods, their underlying theory and interpretation procedures. Field techniques for concentrated shallow surveys or deep crustal surveys are given. The instrumentation for the shallow surveys consists of commercially available components, whereas the equipment for the deep measurements was designed and built by DECO. The appendix to this report, A Manual for the Interpretation of Layered Conductivity Curves for the Sequence High-Low-High, by Dr. G. V. Keller, discusses in detail many of the problems associated with the real earth in contrast to the idealized earth for which most of the theory has previously been developed. Theoretical curves for several two and three layer cases, effective spacing curves and cross dipole curves are included in the set of curves. Author (TAB)

N66-21500# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
ABOUT THE ACCURACY OF DETERMINING COORDINATES OF FEATURES OF TOPOGRAPHIC MAPS [O TOCHNOSTI OPREDELENIYA KOORDINAT OBYEKTOV NA TOPOGRAFICHESKIKH KARTAKH]
V. V. Ivanov Feb. 1966 8 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), issue 10, Oct. 1964 p 42–45
(TC-987; AD-627861) CFSTI: HC $1.00/MF $0.50

Types of errors occurring topographic maps are discussed, and absolute magnitudes of errors are tabulated in terms of orienting points and other features, and for black-and-white and chromatic printings. Mean square errors in the positions of features are obtained, and these values are used to determine the coordinates of the maps. Accuracy of the determination of the coordinates is given for reference points, orienting points, and other features. M.W.R.

N66-21503# National Observatory of Athens (Greece). Seismological Inst.
AFTERSHOCK SEQUENCE AND CRUSTAL STRUCTURE IN THE REGION OF GREECE Annual Summary Report No. 1, 1 Jun. 1964–31 May 1965
A. G. Galanopoulos and Basil C. Papazachos [1965] 7 p
(Contract AF 61(052)-803)
(AFOSR-65-2938; AD-627616)

The object of this study was to determine the wave velocities of body waves, to attempt to calculate the average thickness of the crust and to have an estimation about the change of the thickness of the crust from place in the region considered. The first problem was to identify the most prominent phase and find its travel time curves. Different procedures were followed to determine the travel time curves for epicentral distances between 0 and 150 km and for epicentral distances between 200 and 1000 km. By using data from 250 earthquakes with epicenters near the station of Athens, the velocities of the direct P and S waves were found to be equal to 5.25 km/sec and 3.19 km/sec, respectively. The determined mean focal depth of these earthquakes is 7 km. By using data from about 1000 earthquakes with epicenters in the region of Greece the most prominent phases for epicentral distances between 0 and 1000 km were identified. Their travel time curves were also determined. TAB

N66-21576 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPROXIMATE EVALUATION OF THE INFLUENCE EXERTED BY THE ALBEDO INHOMOGENEITY ON STREAMS OF RECEDING SHORTWAVE TERRESTRIAL RADIATION
K. Ya. Kondrat'yev and M. P. Fedorova *In its* Cosmic Res., vol. 3, no. 5 20 Jan. 1966 p 103–112 refs (See N66-21566 11-30) CFSTI: HC $6.00/MF $1.25

This paper contains theoretical calculations of the integral receding shortwave radiant fluxes from the earth and atmosphere toward variously oriented two-dimensional surfaces in the atmosphere at a height of 300 km. An approximate evaluation has been obtained for the influence exerted by the nonuniformity of the surface albedo on the nature of the receding shortwave radiation to which the variously oriented surfaces in the atmosphere are exposed. Calculations have been carried out for various optical situations in the atmosphere. The calculations that have been carried out are necessary for the proper interpretation of the satellite measurement data relating to the receding radiation, as well as four purposes of evaluating the thermal regime of the satellite. Author

N66-21584*# Geological Survey, Washington, D. C.
ASTROGEOLOGIC STUDIES. PART B: CRATER INVESTIGATIONS Annual Progress Report, 1 Jul. 1964–1 Jul. 1965
H. G. Wilshire et al Oct. 1965 184 p refs
(NASA Order R-66)
(NASA-CR-71420) CFSTI: HC $5.00/MF $1.00 CSCL 08G

Results of field investigations and laboratory studies of volcanic, explosive, and impact events and other aspects of crater phenomenology are summarized in connection with a long-term astrogeological program to determine the structure and origin of the Moon's crust. Structures and other aspects of three naturally formed terrestrial craters, in Australia, Tennessee, and Texas, are discussed. Mercury distribution in shocked and unshocked rocks at the Odessa meteorite craters in Texas is detailed, along with (1) the possible origin of pseudotachylite from Archean granite of the Vredefort dome in Africa and (2) the geology of a large body of granite in Colorado that is being considered as a site for conducting high-explosive cratering experiments in hard, polymineralic rocks. The Moses Rock diatreme in Utah and its similarity to rilles on the lunar surface is reported. Two experimental impact studies deal with (1) impact of craters formed in water-saturated sediments by impacting missiles, and (2) fragmented material produced by two colliding spheres of basalt. M.W.R.

N66-21626# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
GEOPHYSICS AND SPACE DATA BULLETIN, VOLUME II, NUMBER 1
Anne L. Carrigan and Norman J. Oliver, ed. [1965] 281 p refs
(AD-621314) CFSTI: HC $6.00/MF $1.50

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N66-21627 Weston Observatory, Mass.
COMPONENT AND TOTAL FIELD INTENSITY MAGNETOMETER
John F. Devane *In* AFCRL Geophys. and Space Data Bull., vol. II, no. 1 [1965] p 3–13 (See N66-21626 11-13) CFSTI: HC $6.00/MF $1.50

Tabulated data are presented of hourly mean values of the geomagnetic elements (horizontal intensity, declination, and vertical intensity), total field intensity, and the Weston index of magnetic activity for the Air Force Magnetic Test Facility, Weston, Massachusetts. The hourly values of each of the geomagnetic elements and of the total intensity represent the means for successive period of 1 hour each, with the first value in each column beginning at midnight GMT. The instrumentation used is briefly described. R.N.A.

N66-21629 Air Force Cambridge Research Labs., Newburyport, Mass. Plum Island Field Site.
OBLIQUE BACKSCATTER RADAR
Chester Malik and Richard Hartke (Wentworth Inst.) *In* AFCRL, Bedford, Mass. Geophys. and Space Data Bull., Vol. II, No. 1 [1965] p 39–77 (See N66-21626 11-13) CFSTI: HC $6.00/MF $1.50

This paper describes and discusses the results obtained with an oblique-incidence ionospheric sounder located at AFCRL Plum Island Field Site, Newburyport, Massachusetts. The data, recorded on compressed time scale film and on the familiar PPI type frame, include auroral, field aligned, sporadic E, and F layer returns. Graphical examples of typical returns are provided and explained. R.N.A.

N66-21631 Air Force Cambridge Research Labs., Bedford, Mass.
RIOMETER
Samuel Horowitz *In its* Geophys. and Space Data Bull., Vol. II, No. 1 [1963] p 87–176 refs (See N66-21626 11-13) CFSTI: HC $6.00/MF $1.50

The riometer (relative ionospheric opacity meter) is a device for measuring ionospheric absorption using the cosmic noise method. Riometric data recorded on Esterline-Angus charts are included from Bedford, Massachusetts (22, 30, and 62.55 Mc); Hermanus, South Africa (30 Mc); Sao Jose dos Campos, Brazil (30 Mc); and Thule, Greenland (30 Mc). The geographic and geomagnetic coordinates of these and other riometer sites are tabulated. The various classes of ionospheric absorption are described along with details of the radiometer equipment and method of data reduction. R.N.A.

N66-21634 Ionospharen-Institut Breisach (West Germany).
VERTICAL INCIDENCE IONOSPHERIC SOUNDINGS
Karl Rawer and Michael Anastassiades (Natl. Obs. of Athens) *In* AFCRL Geophys. and Space Data Bull., Vol. II, No. 1 [1965] p 243–272 refs Prepared jointly with Natl. Obs. of Athens (See N66-21626 11-13) CFSTI: HC $6.00/MF $1.50

Echo amplitudes from vertical incidence ionospheric soundings made at Freiburg, Germany, are recorded automatically on eight different frequencies and transmitted in sequence for 22.5 sec each. The total transmission time of 3 min is repeated eight times each half hour. By adjusting the brightness of a cathode ray tube, the temporal variation of the echo amplitude is recorded as a blackness distribution at the peak of the amplitude. The mean amplitude is read from this blackness distribution. Using the calibration curve of the receiver, the input voltage (in dB) is obtained from the amplitude directly. After reduction to the same virtual height, the absorption loss L (in dB) follows by comparing the observed input voltage with the mean night value. The nocturnal control measurement is made at 2400 h GMT. The calibration value is found by taking the running mean value for 14 days. In the data tables shown, an absorption value L is given to every frequency for each of the two quarters of an hour at noon GMT. The letters used for absorption measurements are defined. R.N.A.

N66-21649*# McGill Univ., Montreal (Quebec).
ATLAS OF INTERPRETED PHOTOGRAPHY OF SOUTHERN AFRICA FROM TIROS SATELLITES I TO VIII
A. Morrison, J. B. Bird, and M. Lundgren Nov. 1965 119 p refs
(Contract NASr-140)
(NASA-CR-71391) CFSTI: HC $4.00/MF $0.75 CSCL 08B

Complete coverage and detailed interpretation of the surface features of southern Africa are presented in an Atlas which is based on photographs taken by TIROS satellites I through VIII. Both TIROS photographs and maps which show geological and other features of the area are included in the report. It is pointed out that it is usually impossible to determine the specific features of an unknown area from TIROS photographs by themselves, and that the pictures complement those found in general-purpose atlases. The quality, distribution, and frequency of coverage permit the study of the permanent features of the area, but changes in surface conditions cannot be followed. Surface features larger than about 20 by 10 miles are regularly visible. M.W.R.

N66-21650*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
VARIATIONS OF THE EARTH'S GRAVITATIONAL FIELD FROM CAMERA TRACKING OF SATELLITES
William M. Kaula [1966] 27 p refs *Its* Publ. No. 487
(Contract NSR-05-007-060)
(NASA-CR-71392) CFSTI: HC $2.00/MF $0.50 CSCL 08N

7,234 Baker–Nunn camera observations of five satellites were analyzed to determine simultaneously 44 tesseral harmonic coefficients of the gravitational field, 36 station coordinates and 511 orbital elements. Supplementary observational data incorporated in the solution included accelerations of 24-hour satellites and directions between tracking stations from simultaneous observations; observation equations were also written for the differences between geometrical and gravitational geoid heights at tracking stations. Several variations in relative weighting of different observational data and a priori variances of parameters were tested. The previous independent solution most closely approached was that by Anderle based on Doppler data, from which the rms

discrepancy was $\pm 0.18 \times 10^{-6}$ for 38 normalized harmonic coefficients, or ±7 meters in total geoid height. An equatorial radius of 6,378.153 ±8 m was obtained. Author

N66-21664*# Geological Survey, Washington, D. C.
REFLECTANCE MEASUREMENTS IN THE 0.6 TO 2.5 MICRON PART OF THE SPECTRUM
Reinhold Gerharz and William A. Fischer 1 Feb. 1966 17 p ref *Its* Tech. Letter NAS-8
(NASA Order R-146)
(NASA-CR-71407) CFSTI: HC $1.00/MF $0.50 CSCL 08G

Preliminary observations indicate that some rocks and minerals selectively absorb electromagnetic energy in the 0.6 to 2.5 micron part of the spectrum, and many of these observations correspond closely to positions in known atmospheric absorption bands. The observed bands are believed to relate to the absorption characteristics of the rock specimens rather than that of the intervening atmosphere. Measurements were made with a DK-1 Beckman infrared spectrophotometer, which is not considered ideal for such reflectance investigations. Spectral resolution varies with wavelength for this spectrometer, which was used with an integrating sphere. M.W.R.

N66-21688*# National Aeronautics and Space Administration, Washington, D. C.
THE ESTIMATION OF OZONE CONCENTRATION AT THE HEIGHTS OF 44–102 KM DURING NIGHT LAUNCHINGS OF GEOPHYSICAL ROCKETS [OTSENKA KONTENTRATSII OZONA NA VYSOTAKH 44–102 KM VO VREMYA NOCHNYKH ZAPUSKOV GEOFIZICHESKIKH RAKET]
A. Ye. Mikirov Feb. 1966 9 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 5, no. 6, 1965 p 1120–1123
(NASA-TT-F-10006) CFSTI: HC $1.00/MF $0.50 CSCL 04A

High-altitude measurements of atmospheric brightness as a function of altitude under lunar illumination are used for determining ozone concentration at altitudes between 44 and 102 km. The experimental conditions and formulas used in the calculations are given. The experimentally determined value of $\sim 0.10^{-19}$ O_3 molecules/cm^3 above 44 km agrees satisfactorily with the data in the literature. Author

N66-21707 East African Meteorological Department, Dar-es-Sallam (Tanzania).
LAKE LEVELS IN EAST AFRICA
David J. Bargman, F. E. Lumb, and H. T. Mörth *In* Miami Univ. Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 2–13 refs (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50

The profiles of Lakes Nyasa, Victoria and Tanganyika are examined in relation to the climate. For Lake Victoria, the best documented of the lakes, certain relationships are shown between rainfall, runoff, evaporation and outflow and the delicate balance is demonstrated. The extremely high rises in 1961 continuing to 1964 are described. Speculation on the causes, including climatic change to wetter conditions and a possible correlation with the 26 month upper wind reversal is offered. Author

N66-21722 Woods Hole Oceanographic Institution, Mass.
LOW-LEVEL GRAVITY WAVES IN OFF-SHORE WINDS
E. B. Kraus *In* Miami Univ. Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 225–232 refs (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50

Several balloon ascents were observed in an offshore wind to study the formation of gravity waves. It is pointed out that the observations generally suggest the existence of waves whose crests and troughs remain at about the same distance from the coast between successive ascents. The waves develop most strongly at an approximate distance of three km from the coast. Altitude and number are largest about noon when the Väisälä frequency is highest. There seems to be some indication that the longer waves become more prominent at the higher elevations. It was also observed that the waves are associated with downward velocities in excess of 2 m/sec close to the sea surface, and that they seem to be related to a bank of maximum whitecap development. D.T.

N66-21731# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands). Advies Bureau der Genie.
BEHAVIOR OF THE GROUND AND GROUND WATER IN THE NETHERLANDS UNDER DYNAMIC LOADS, ESPECIALLY DYNAMIC LOADS RESULTING FROM A NUCLEAR EXPLOSION [HET GEDRAG VAN DE BODEM EN HET GRONDWATER IN NEDERLAND BIJ DYNAMISCHE BELASTINGEN IN HET BIJZONDER BIJ DYNAMISCHE BELASTINGEN ALS GEVOLG VAN EEN KERNWAPEN-EXPLOSIE]
Sep. 1965 357 p refs In DUTCH *Its* Rept.-122
(TDCK-43723) CFSTI: HC $7.00/MF $1.75

The behavior of soil and ground water subjected to scaled explosions with conventional charges was investigated. Test sites were uniform beds of sand and clay; ground particle velocities outside the explosion vicinity were monitored by seismographs. Shots fired below and in the weather layer as well as airbursts just above the ground were registered. Recordings made with geophones planted in the ground revealed that large amplitude air-coupled waves arrived through the ground after the initial first waves from above ground blasts. At shallow depths (<2.5 m) air-coupled waves were found. Surface waves from shallow ground shots were identified as Raleigh waves. It was concluded that the induced ground shock from explosions located above the ground surface contained the largest part of destructive energy compared to other waves generated in the ground from the same shot. G.G.

N66-21743# Weapons Research Establishment, Salisbury (Australia).
BASIC ATMOSPHERIC PARAMETERS AS MEASURED BY FOUR FALLING SPHERE EXPERIMENTS AT WOOMERA, DECEMBER 1964–MARCH 1965
P. H. O. Pearson Nov. 1965 38 p refs
(WRE-TN-PAD-109) CFSTI: HC $2.00/MF $0.50

Further four falling sphere experiments were conducted at Woomera from December, 1964 to March, 1965. These results complete the first full year of measurements in a series to investigate the seasonal variation of density, temperature, pressure and winds shortly after sunset. Author

N66-21745# Joint Publications Research Service, Washington, D. C.
STUDIES IN ATMOSPHERIC DYNAMICS
T. P. Krupchatnikova, V. P. Litouchenko, N. K. Yinnichenko, N. Z. Pinus, V. I. Chernysh et al 30 Mar. 1966 26 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ., Vyp. Dinam. Atmosfery (Leningrad), no. 63, 1965 p 31–38, 77–84
(JPRS-34809; TT-66-31248) CFSTI: $1.00

The problem of determining the parameters of turbulence in jet streams is considered, taking into account the nonuniformity of the wind field in the horizontal plane. Computations of the coefficient of turbulence and wind gustiness are made for the cyclonic side of jet streams. The boundary layer method is used and it is assumed that in the horizontal direction the wind attenuates with increasing distance from the axis of the flow in conformity to the exponential law. Author

N66-21791# Centre National de Recherches de l'Espace, Brussels (Belgium).
THE PROBLEM OF SCALE HEIGHTS AND THEIR GRADIENTS IN THE HETEROSPHERE [LE PROBLEME DES HAUTEURS D'ECHELLE ET DE LEURS GRADIENTS DANS L'HETEROSPHERE]
G. Kockarts Dec. 1963 32 p refs In FRENCH; ENGLISH summary Presented at the Roy. Acad. of Sci., 14 Dec. 1963 Submitted for Publication CFSTI: HC $2.00/MF $0.50

The properties of the heterosphere are discussed in terms of the behavior of scale heights and their gradients. The height variation of the mean molecular mass leads to important gradients of scale heights in the isothermal region of the heterosphere. An analysis of the atmospheric scale height H and the density scale height H which increases with altitude shows that $H \geq H_\rho$ everywhere. Their positive gradients β and β_ρ may have all possible values between 0 and 1.5. The gradient β_ρ is not less than β in the thermosphere, but may be greater or less than β in the isothermal region depending on the thermopause temperature. Author

N66-21803# National Physical Lab., New Delhi (India).
ELECTRON DISTRIBUTION IN THE IONOSPHERE OVER DELHI
K. K. Mahajan 15 Sep. 1965 52 p refs
(RPU-S23) CFSTI: HC $3.00/MF $0.50

A study of electron distribution for magnetically quiet and disturbed days is made from true height profiles obtained from the C4 ionograms recorded during the IGY and IGC. The results for quiet days indicate that the profiles are, approximately, α-Chapman type near the peak and exponential lower down. The well known winter anomaly and the diurnal asymmetry are found to exist at all heights in the F2 layer. Electron distribution for magnetically disturbed days indicates that the disturbed ionosphere results in the decrease of electron density at all levels above about 200 km, decrease of the subpeak electron content and increase in the thickness of the F2 layer. The height of the maximum ionization of the F2 layer, h_mF_2 increases considerably on the disturbed nights. Analysis of some severe and moderately severe magnetic storms indicates that the magnitude of decrease in the electron density is maximum near the peak of the undisturbed layer. Author

N66-21815*# New York Univ., N. Y. Dept. of Meteorology and Oceanography.
EQUILIBRIUM TEMPERATURE STRUCTURE IN THE MESOSPHERE AND LOWER THERMOSPHERE
C. Prabhakara (NASA. Goddard Inst. for Space Studies) and Joseph S. Hogan Jan. 1966 44 p refs
(Grant NsG-499; Proj. HIAM)
(NASA-CR-71535; TR-66-1) CFSTI: HC $2.00/MF $0.50 CSCL 04A

Calculations have been made of the radiative equilibrium temperature structure of the Earth's mesosphere and lower thermosphere, taking into account solar ultraviolet heating, and cooling by CO_2 and O_3. For the evaluation of the absorption of solar energy, an equilibrium distribution of O_3 consistent with the temperature structure was calculated from the basic photochemical equations. A "statistical" band model which takes into account both Lorentz and Doppler broadening of the spectral lines was employed in the determination of the atmospheric transmissions for both 15μ CO_2 and 9.6μ O_3 bands. The departure from conditions of local thermodynamic equilibrium in the 15μ CO_2 band due to vibrational relaxation was taken into account and the source function in this band was calculated over a range of relaxation times from 10^{-6} sec to 1.5×10^{-5} sec. The radiative equilibrium temperature calculations result in a pronounced temperature minimum in the vicinity of 80 km, corresponding to the Earth's mesopause. Author

N66-21816*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
MEASUREMENT OF ELECTRON CONTENT AT THE MAGNETIC EQUATOR
William J. Ross 30 Mar. 1966 35 p refs *Its* Sci. Rept.-268 (Grant NsG-114-61)
(NASA-CR-71536) CFSTI: HC $2.00/MF $0.50 CSCL 04A

Values of the vertical column electron content of the ionosphere at Huancayo, Peru, are presented for an eighteen month interval. These data were obtained from an analysis of Faraday rotation data from a radio beacon satellite. The daytime electron content is found to vary with the 10.7 cm solar radio flux, and after normalization for this dependence the average diurnal variation is found to be quite regular with a range of about 20:1. A biannual variation in the daytime electron content is found also, with maxima near the equinoxes and with a range of about 2:1. Author

N66-21842# Columbia Univ., Palisades, N. Y. Lamont Geological Observatory.
SYMPOSIUM ON DIFFUSION IN OCEANS AND FRESH WATERS
Takashi Ichiye, ed. Dec. 1965 173 p refs Symp. held Aug. 31–Sep. 2, 1964
(Contracts AT(30-1)-2663; Nonr-266(48))
(AD-627883) CFSTI: HC $5.00/MF $1.00

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17. OCEAN WAVE BOUNDARY LAYERS C. E. Grosch and S. J. Lukasik (Stevens Inst. of Technol.) p 149–150 refs

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19. TURBULENT DIFFUSION IN SODIUM VAPOR TRAILS IN THE UPPER ATMOSPHERE O. R. Cotè (Geophys. Corp. of Am., Bedford, Mass.) p 153–156 refs

N66-21858# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131; 48°03'18" N, 07°35'24" E, APRIL–JUNE 1964 [IONOSPHAREN-DATEN, VERTIKAL-ECHOLOTUNG' FREIBURG, URIS-CODE 131; 48°03'18" N, 07°35'24" E, APRIL–JUN 1964]
[1964] 127 p In GERMAN and ENGLISH
(Rept.-214-F; Rept.-215-F; Rept.-216-F) CFSTI: HC $4.00/MF $1.00

Presented is a tabulation of ionospheric characteristics and punchcard codes. Included are such ionospheric cata as ordinary wave critical frequency for the F2-, Fl-, and E-layers, lowest ordinary wave frequency at which Es is effectively transparent, lowest usable frequency showing vertical ionospheric reflections. The data was recorded at the Freiburg station, URSI-code 131; 48° 03' 18" N, 07° 35' 24" E, and covers the period April, May, and June 1964. M.R.W.

N66-21862# Library of Congress, Washington, D. C. Aerospace Technology Div.
FOREIGN SCIENCE BULLETIN, VOLUME 2, NUMBER 3
Mar. 1966 80 p refs

Presented is a compilation of selected foreign scientific and technical literature sponsored by the Department of Defense. Some of the topics considered are: the method of potential functions, two-photon optically pumped semiconductor lasers, the controlling zone in the combustion of composite propellants, new trends in the development of aromatic polyesters in the USSR, loss in antenna gain in long-haul UHF tropospheric propagation, microwave techniques for lasers, solid fuels for ramjet engines, high-temperature properties of liquid alkali metals, and effect of fillers on the morphological forms and mechanical properties of crystaline polymers. Reports are included on the following conferences: the spectral transparency of the atmosphere in the visible and infrared regions of the spectrum, and problems in material science. Reviews are presented for the following books: *Molecular Scattering of Light*, and *Methods of Studying the Most Recent and Contemporary Tectonics of the Shelf Zones of Seas and Oceans*. A brief biography on Lev Davidovich Landau is also included. M.R.W.

N66-21891# Boston Coll., Chestnut Hill, Mass.
PHOTOGEOLOGY OF THE SAHARA AND THE KALAHARI FROM TIROS Scientific Report No. 1
James W. Skehan, S. J. Arabasz, and Walter J. Arabasz 15 Dec. 1965 44 p refs
(Contract AF 19(628)-3990)
(AFCRL-65-229; AD-628080) CFSTI: HC $2.00/MF $0.50

Photogeologic analysis of TIROS photography of the Sahara and Kalahari regions of western Africa demonstrate the limited applicability of such satellite photography to geologic studies of Earth. Author (TAB)

N66-21894# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTENSITY CONNECTION OF THE ELECTRIC FIELD OF THE ATMOSPHERE WITH AURORA POLARIS
T. V. Lobodin 21 Oct. 1965 10 p refs Transl. into ENGLISH from Geophys. Bull. (Moscow), no. 13, 1963 p 38–40
(FTD-TT-65-855/1+2+4; AD-628037) CFSTI: HC $1.00/MF $0.50

An investigation was made of the effect of polar auroras on changes in the atmosphere's electric field intensity. The electric field measurements were made with the aid of an electrostatic fluxmeter and a continuous electrostatic potentiometer tape recording. An increase was observed in the southern circle during the auroras, while a decrease was observed in the northern circle; indicating that the polar auroras behave as a positive volumetric charge in the southern hemisphere and a negative charge in the northern hemisphere. A table of numerical values for corrections in the field intensity due to diurnal variations is included. C.T.C

N66-21918# St. Louis Univ., Mo. Inst. of Technology.
MODEL STUDY OF EXPLOSION-GENERATED SEISMIC WAVES Final Report, 1 Oct. 1962–1 Oct. 1965
Carl Kisslinger Bedford, Mass., AFCRL, 1 Oct. 1965 82 p refs
(Contract AF 19(628)-1689; ARPA Order 292-62)
(AFCRL-65-829; AD-627038) CFSTI: HC $3.00/MF $0.75

The generation of seismic waves by an explosive source in homogeneous media was investigated by two dimensional models. The size of the effective source for compressional waves agrees well with the outer limits of the zone of circumferential cracking in a brittle medium. Prominent shear waves appear only when the source produces long radial cracks, is located near the free surface of the model, or the source is elongated. The radiation of both types of body waves is strongly modified when the source is near the surface. The P-wave spectrum can be modified by surrounding the shot with a different material. A cavity, filled with air or a solid substance, affects the signal through both its geometric configuration and the properties of the material in the cavity. The evidence from Rayleigh waves indicates that the effect of an explosion changes from a vertically applied source

pulse to a buried center of compression when the source depth exceeds the radius of the zone of nonelastic behavior. When the medium is statically stressed before the shot, the body waves are modified. A low velocity wedge modifies wave propagation by creating a shadow zone. Diffractions into this shadow zone from the wedge tip were observed.

Author (TAB)

N66-22080# Geophysics Corp. of America, Bedford, Mass. GCA Technology Div.

SEDIMENTATION AND DISPERSION OF PARTICULATE CLOUDS IN THE UPPER ATMOSPHERE. CIRCULATION PROCESSES AND MIXING MECHANISMS IN THE UPPER ATMOSPHERE ABOVE 30 KM Final Report

Owen Coté Mar. 1965 129 p refs Prepared for Sandia Corp.

(Contract AT(29-1)-789)

(GCA-TR-65-4-G; SC-DC-65-1312) CFSTI: HC $4.00/MF $1.00

The factors affecting the fall speed and relative dispersion of small particles—1 to 100 micron diameter and 5 g/cm^3 density—are considered in this study. Terminal fall speeds, corrected for slip flow, and the total gravitational settling time from 70 to 30 km are computed using atmospheric parameters taken from the ARDC model atmosphere (1959). The influences of particle shape and orientation, of photophoresis, and of hydrodynamical interaction between the particles in a cloud on fall speed are reviewed and shown to be significant. Transport and dispersion processes affecting the cloud are assumed to be independent. The total gravitational settling time to 100,000 feet is taken to represent the time available for atmospheric dispersion. The relative dispersion of the particle cloud is calculated assuming a Gaussian cloud distribution having a variance or relative dispersion $\sigma^2 = 2K_e t$. The magnitude of the effective eddy diffusion coefficient, K_e, is based upon both observed radioactive debris dispersion and theoretical studies of atmospheric dispersion. Maximum particle concentrations to be expected at 100,000 feet are equated to particle concentrations at the center of the model cloud. The surface concentration is discussed in terms of the present model and recommendations are made for refining the method of concentration calculation.

Author (NSA)

N66-22085# Bettis Atomic Power Lab., Pittsburgh, Pa.

ANALYTICAL MODEL FOR BLOWDOWN EXPERIMENTS

S. G. Margolis and J. A. Redfield Apr. 1965 15 p refs Presented at the Am. Nucl. Soc. 11th Ann. Meeting, Gatlinburg, Tenn., Jun. 1965

(Contract AT(11-1)-GEN-14)

(WAPD-T-1791; CONF-650602-31) CFSTI: HC $1.00/MF $0.50

A model is described which has been found useful in describing the blowdown of simple tanks containing a two-phase stream–water mixture. Pressure in the vessel is found from overall mass and energy balances. A separate mass balance on the steam held as bubbles in the lower phase determines the level of the two-phase mixture. Efflux is calculated using the Moody correlation. Good agreement with experiment has been observed for both high and low leaks ranging from 1 inch to 3.75 inches in diameter.

Author (NSA)

N66-22132# Los Alamos Scientific Lab., N. Mex.

DENSITY OF THE IONIZED UPPER ATMOSPHERE TO 5600 KILOMETERS

Leslie C. Hale, Willard H. Bennett, and David N. Anderson (N. C. State Coll.) [1964] 18 p refs Prepared jointly with N. C. State Coll.

(Contract W-7405-ENG-36)

(LA-DC-6509) CFSTI: HC $1.00/MF $0.50

A re-evaluation was carried out on the flight data obtained on a four-grid ion probe in the Scout vehicle launched on Oct. 4, 1960. Laboratory calibrations of the ion probe were carried out, and the significance of the change to a negative scale height in the flight data was assessed. The results suggest that the radiation belts containing magnetically trapped high-energy particles should also contain increased densities of trapped low-energy ions and electrons. (NSA)

N66-22165# Columbia Univ., Palisades, N. Y. Geochemistry Lab.

INVESTIGATIONS IN ISOTOPIC GEOCHEMISTRY Annual Summary Progress Report No. 10

J. Laurence Kulp Jan. 1965 201 p refs

(Contract AT(30-1)-1669)

(NYO-1669-10) CFSTI: HC $6.00/MF $1.25

A study of basalt system K–Ar dating was completed in which technique advances were made. The method was applied in age determinations of surficial rocks. Work on superimposition of metamorphic and thermal events on rocks from the Manhattan prong and southwestern Connecticut was continued. U–Pb isotopic ages on about 20 zircons from the Norwegian and Swedish basement were completed. Determinations of the K–Ar ages of laramide intrusions in the Rocky Mountain area were also completed. Age measurements on samples from the areas around Fairbanks and Juneau, Alaska are discussed. NSA

N66-22177*# National Aeronautics and Space Adminstration. Goddard Space Flight Center, Greenbelt, Md.

THE CHEMICAL COMPOSITION AND ORIGIN OF MOLDAVITES

J. A. Philpotts and W. H. Pinson, Jr. (MIT) [1965] 35 p refs Submitted for Publication

(NASA-TM-X-56666) CFSTI: HC $2.00/MF $0.50 CSCL 08G

Twenty three new major-element analyses of moldavites are reported. The samples include seventeen Bohemian and six Moravian tektites. The ranges in the contents of the various oxides are as follows: SiO_2, 75.5–80.6; Al_2O_3, 9.62–12.64; TiO_2, 0.268–0.460; Fe_2O_3, 0.12–0.31; FeO, 1.42–2.36; MgO, 1.13–2.50; CaO, 1.46–3.71; Na_2O, 0.31–0.67; K_2O, 3.26–3.81. The Rb and Sr contents and the Rb/Sr ratios are also reported for the 23 specimens; the ranges are as follows: Rb, 120–160 ppm; Sr, 130–156 ppm; Rb/Sr, 0.82–1.20. The densities and refractive index values range from 2.3312 to 2.3718 gm/cm^3 and from 1.486 to 1.495, respectively. In contrast to the australities, the moldavites display significant negative correlations between the alkali metals (Na and Rb) and the alkaline earths. The variations in the chemical composition of moldavites would seem to be unlike those of sedimentary or igneous rocks. It is suggested that the observed variations in composition are largely due to fractional volatilization. The wide range of Rb/Sr ratios in conjunction with the uniformity of the Sr isotopic composition supports this theory. Author

N66-22202*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PHOTOGRAPHIC OBSERVATIONS OF NIGHTGLOW FROM ROCKETS

John Hennes and Lawrence Dunkelman 28 Jul. 1965 11 p refs Submitted for Publication
(NASA-TM-X-56664) CFSTI: HC $1.00/MF $0.50 CSCL 04A

Several very clear photographs of the earth's night airglow horizon over western Texas were obtained at altitudes up to 184 km from an Aerobee rocket launched at 0615 UT, 1 December 1964 from White Sands Missile Range, New Mexico. The vertical distribution of the airglow has been determined, showing the altitude of peak nightglow emission as 95±4 km with 90% of the emission between 80 and 116 km. The striking visual appearance of the airglow layer and surface lights and the altitude determination are compared with the observations reported by various astronauts and with other rocket measurements. Author

N66-22215*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
ANALYTIC REPRESENTATION OF UPPER ATMOSPHERE DENSITIES BASED ON JACCHIA'S STATIC DIFFUSION MODELS
James C. G. Walker [1965] 8 p refs Submitted for Publication
(NASA-TM-X-56450) CFSTI: HC $1.00/MF $0.50 CSCL 04A

A modification in the mathematical procedure used by Jacchia to obtain a set of models of the upper atmosphere designed to reproduce satellite drag density data while requiring the minimum amount of tabulation, is presented. The modification eliminates the numerical integration of the diffusive equilibrium equations, yielding a completely analytical representation of upper atmosphere densities. Calculations for an example, using the modification, are worked out. L.S.

N66-22221*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARLY ELECTROSTATIC PROBE RESULTS FROM EXPLORER XXII
L. H. Brace and B. M. Reddy [1965] 27 p refs Submitted for Publication
(NASA-TM-X-56632) CFSTI: HC $2.00/MF $0.50 CSCL 04A

The electrostatic probe experiment on Explorer XXII has permitted the concentration and temperature of the electrons at 1000 kilometers to be observed on a global scale. The major features of the ionsophere at this altitude are a maximum concentration at the magnetic equator in the daytime which gives way at night to a pair of maxima at 35° north and south. The electron temperature exhibits large variation from day to night at altitudes below 45° but remains high all night at higher latitudes. This behavior is consistent with the heating of the protonosphere by escaping photoelectrons in the daytime, and cooling by thermal conduction to the lower atmosphere both day and night. Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N66-21116# American Science and Engineering, Inc., Cambridge, Mass.
RESEARCH DIRECTED TOWARD THE STUDY OF NUCLEAR RADIATION Final Report, 25 Jan. 1962–24 Jul. 1965
Theodore B. Barrett and Jack W. Carpenter 6 Oct. 1965 111 p refs
(Contract AF 19(628)-349)
(ASE-1111; AFCRL-65-801; AD-627323) CFSTI: HC $4.00/MF $0.75

The design and description of the optical system for installation in the KC-135 airborne laboratory of AFCRL are presented. The optical system consists of a 4-barrel photometer mounted co-axially with a 16 mm, narrow field-of-view camera as well as 35 mm and 16 mm all-sky cameras. The 4-barrel photometer is capable of either fast-time high-level response for use against artificially induced auroras or by use of the chopper and synchronous detection to monitor the very low-level night airglow radiations. The tilting filter technique is employed on the photometer to monitor the continuum contribution to the line and band intensities to be measured. An automatic calibration system using phosphors excited by C^{14} radioisotope decay is incorporated. The photometer uses interference filters centered at 427 8Å, 4861 Å, 5577 Å and 6300 Å. Author

N66-21122# Naval Ordnance Lab., White Oak, Md.
NOL COPPER-BALL ACCELEROMETERS
Valmore F. De Vost 31 Oct. 1965 50 p refs
(NOLTR-63-279; AD-627710) CFSTI: HC $2.00/MF $0.50

The report describes a number of ball-crusher, peak-reading accelerometers and their application for recording simple as well as complex shocks. Some concepts on shock spectra, as they apply to these devices, and a new method for determining the peak of a shock recorded with preset copper-ball accelerometers are discussed. Ten accelerometer models cover a shock range from approximately 30 g to 450,000 g; their corresponding natural frequencies range from 244 cps to 14,800 cps. Author (TAB)

N66-21139# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Reaktorzentrum
EXPERIMENTAL ASCERTATIONS WITH A SEMI-CONDUCTOR COMPTON SPECTROMETER BY MEASUREMENTS OF RESIDUE FROM FUEL ELEMENTS [EXPERIMENTELLE ERFAHRUNGEN MIT EINEM HALBLEITER-COMPTON-SPECTROMETER BEI ABBRANDMESSUNGEN AN BRENNSTOFFLEMENTEN]
L. Buba, H. Hick, and C. Rumpold 1965 16 p refs In GERMAN Submitted for Publication
(SGAE-PH-33/1965) CFSTI: HC $1.00/MF $0.50

A Compton γ spectrometer with a lithium drift silicium detector was utilized to resolve the complicated γ-spectra of spent nuclear fuel elements and to measure the intensity of their Cs-137 line. The number of observed fissions in an ASTRA reactor element showed good agreement with physical neutron measurements and calculations; measurements on 18 parts from a fuel element of the Brookhaven graphite reactor had an agreement of 6.4% with calculated values. This slight discrepancy was attributed to the diffusion of Cs, respectively Xe. Transl. by G.E.

N66-21164# Atomic Weapons Research Establishment, Aldermaston (England).
A NEW LONG-PERIOD VERTICAL-COMPONENT SEISMOMETER

A. D. Beach Nov. 1965 47 p refs
(AWRE-O-70/65) HMSO: 8s

A seismometer is described whose performance is intended to be comparable with the best existing vault instruments and yet which should be suitable for field work at remote sites. It incorporates a new type of leaf-spring suspension, which allows long periods to be attained, yet permits severe handling of the fully assembled instrument. The leaf-spring suspension is found to be superior to the usual helical spring system, in that transverse and other modes of vibration of the spring itself are of higher frequency than most noise sources, thereby avoiding resonances which can lead to spurious long-period response. Author

N66-21172# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
ANALYSIS OF INFRA-RED ONE-DIMENSIONAL PICTURES BY FOURIER TRANSFORMATION [ANALYSE D'IMAGES INFRA-ROUGE UNIDIMENSIONNELLES PAR TRANSFORMATION DE FOURIER]
Jean Berny Dec. 1965 128 p refs In FRENCH; ENGLISH summary
(TN-85) CFSTI: HC $4.00/MF $1.00

The analysis of a distribution of luminance on a surface is carried out in a conventional manner by isolating each surface element by means of a field stop which determines by its size the resolving limit. The process suggested here is based on the use of a grill providing analogically the Fourier transform of the one-dimensional image of the studied luminances. As in the case of Fourier transform spectroscopy a gain of luminosity is obtained for an equal reception surface; this gain is equal to the square root of the number of discernable elements on this image. An application of this method to point source spectrometery has been considered (stellar spectrometry). Other applications of the grills used are presented. Author

N66-21197# United Kingdom Atomic Energy Authority, Culham (England). Culham Lab.
A NANOSECOND SAMPLING TECHNIQUE TO AID MULTICOIL MAGNETIC PROBE MEASUREMENTS
G. L. Godfrey 1966 11 p
(CLM-R-50) HMSO: 1s 9d

An electronic instrument is described which enables 32 separate input signals to be sampled in sequence in a total time of 1 microsecond, each signal being sampled for 20 nanoseconds. The 32 samples are mixed together at the output. Author

N66-21215# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TOTAL PRESSURE PROBE FOR A SUPERSONIC GAS FLOW WITH A SLIGHTLY NONUNIFORM VELOCITY FIELD
M. P. Ryabokon 8 Dec. 1965 6 p Transl. into ENGLISH from Russian Patent no. 165328 (Appl. no. 823324/26-10, 4 Mar. 1963) 2 p
(FTD-TT-65-1130/1+2+4; AD-625064) CFSTI: HC $1.00/MF $0.50

The object of the invention is a probe of the full pressure in a supersonic flow of a gas with a slightly nonuniform field of velocities representing an axisymmetrical body with pressure-taking tubes. For the purpose of improving the precision of the measure of the full pressure, the contour of the body is designed in the form of an eccentric surface which checks the flow (retarding it) from the supersonic down to the transonic velocity, and the probe tubes are located at the end of the zone of retardation. Author (TAB)

N66-21223*# Hy-Cal Engineering, Santa Fe Springs, Calif.
LOW LEVEL GAS PURGED RADIOMETER MODEL NO. R8100A, PHASE II Final Report
B. Rappaport Nov. 1965 28 p
(Contract NAS8-5490)
(NASA-CR-71029) CFSTI: HC $2.00/MF $0.50 CSCL 20E

The design, development, fabrication, and testing of a wide angle low heat flux level gas purged radiometer are reported. The applicability of the Hy-Cal Engineering Hy-Therm calorimeter concept was investigated. With minor modifications to the design a sensor was evolved which was capable of providing the desired output for all three ranges. The final instruments were fabricated using this sensor, designated the "Hy-Therm". A photograph and drawing of the final instrument are included. M.R.W.

N66-21242# European Atomic Energy Community, Brussels (Belgium).
CONDUCTANCE METER FOR POLARISABLE LIQUIDS [CONDUCTANCEMETRE POUR LIQUIDES POLARISABLES]
A. Bret and L. Stanchi Jan. 1966 18 p In FRENCH; ENGLISH summary
(EUR-2633.f) CFSTI: HC $1.00/MF $0.50

An instrument for conductivity measurements in polarizable liquids is described. In particular the instrument is used for the terphenyls. The special characteristics of these liquids do not allow the use of conventional instruments. In the present experiment a square wave, with a frequency so high to prevent the polarization of the liquid, crosses the liquid and gives on a series resistor a signal which is proportional to the conductance of the liquid. The measurement is controlled by a synchronous detector which takes a sample of the voltage after the transients are elapsed. Author

N66-21243# European Atomic Energy Community, Brussels (Belgium).
DECIMAL SCANNER FOR THE MODULAR CHAIN
N. Coppo and L. Stanchi Jan. 1966 18 p
(EUR-2702.e) CFSTI: HC $1.00/MF $0.50

A decimal scanner which is used to perform the step by step variation of a voltage is described. There is a series of resistors connected in such a way that if a current is sent to them it is possible to obtain a voltage scanned step by step in 101 channels. Five modes of operation are foreseen: (1) upward scanning and stop, (2) downward scanning and stop, (3) upwards and downwards and stop, (4) upwards and downwards indefinitely, (5) upwards with fast flyback indefinitely. Suitable circuits for external controls are included. Author

N66-21245# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
SPIN ECHO SPECTROMETER [SPEKTROMETR ECHA SPINOWEGO]
W. Antoniak and J. Camielewski 1965 48 p In POLISH; ENGLISH summary
(IBJ-619/XV/E) CFSTI: HC $2.00/MF $0.50

This report describes a nuclear magnetic resonance spectrometer based on the spin echo technique. The spectrometer, used to measure moisture in different solid substances, consists of an electromagnet measuring head with crossed coils, preamplifier, r.f. amplifier, pulse voltmeter, pulse transmitter, pulse pair generator, and auxiliary units such as power supply. Results of moisture measurements performed on several substances and the corresponding relaxation times are reported. M.R.W.

N66-21248# Atomic Weapons Research Establishment, Aldermaston (England).
A CRYSTAL NEUTRON MONOCHROMATOR
J. M. A. Reichelt Dec. 1965 20 p refs
(AWRE-O-98/65) HMSO: 2s 6d

A neutron monochromator which uses diffraction from an aluminum crystal is described. The instrument provides a beam of neutrons of 1.46 eV and has been used for radiographic measurements in conjunction with a resonance energy detector. The mosaic characteristics of large aluminum single crystals have been investigated and these have led to an improvement in crystal growing technique, resulting in a single crystal with small mosaic spread. Author

N66-21252# HRB-Singer, Inc., State College, Pa.
SIMULATION RESEARCH ON NON-IMAGE SENSOR SYSTEMS Interim Report
Joseph L. Oneill Jul. 1965 26 p ref
(Contract Nonr-2818(00))
(Rept.-352-R-16; AD-617384) CFSTI: HC $2.00/MF $0.50

This report describes interim results in a research effort on simulation methodologies. The concern is with advanced intelligence collection systems capable of operating in any environment and in any spectral or force field region. The work is being done for the Information Systems Branch of the Office of Naval Research. TAB

N66-21279# Atomic Energy Establishment, Winfrith (England). Radiological and Safety Div.
AN EXPERIMENTAL SYSTEM FOR THERMOLUMINESCENT DOSIMETRY
K. E. G. Perry and E. George Aug. 1965 31 p refs
(AEEW-R-411) HMSO: 7s

A thermoluminescent dosimeter reader has been developed for experimental investigations on the use of lithium fluoride for finger tip dosimetry. The design of the reader is based on the maximum use of standard electronic units in the A.E.R.E. Type 2000 series but some new unit development has been necessary. The reader gives improved experimental facilities over present commercially-available designs. The technique for finger-tip dosimetry is described and the initial experimental results are given. Author

N66-21307# Naval Ordnance Test Station, China Lake, Calif.
DEEP-SEA LIGHT ATTENUATION MEASUREMENTS AT 2,000-METER DEPTHS
Gary D. Gilbert Dec. 1965 24 p refs
(NOTS-TP-3994; AD-626409) CFSTI: HC $1.00/MF $0.50

The null-balance transmissometer (NBT) is an instrument being developed to measure the volume attenuation coefficient of light in the sea to depths of 2,000 meters. In earlier tests (AD-613 017), the operation of the NBT was tested in its working environment to depths of 700 meters. In this report, the first deep sea tests of the NBT, in which measurements were made to the 2,000-meter maximum depth capability of the instrument, are documented. The tests were conducted at 10 locations in the North Pacific from the Aleutian Islands to the island of Oahu in the Hawaiian Archipelago. Author (TAB)

N66-21356 Princeton Univ., N. J. Dept. of the Aerospace and Mechanical Sciences.
TRANSIENT PRESSURE MEASURING METHODS RESEARCH Summary Technical Report, 1 Jan.–30 Jun. 1965
J. P. Thomas 16 Nov. 1965 138 p refs *Its* Aeron. Eng. Rept. 595p
(Contracts NASr-36; NAS8-11216)
(NASA-CR-71401) CFSTI: HC $4.00/MF $1.00 CSCL 14B

Tranducer evaluations in the laboratory and in test rocket motors continued primarily on noncooled transducers in cooled adapters and on variations of the Princeton small passage technique. Late model Dynisco PT49CF transducers are discussed since their most recent modification had a direct bearing on developing the model PT134 transducers. Redesign and further development of the model PT134 transducers prevented the intensive testing needed to fully evaluate this advanced water cooled flush diaphragm transducer. Several models of cooled adaptors were recalled because of obsolescence before laboratory evaluations were completed. A study of the dynamic response of small passage connected transducers, as affected by passage length and volume geometry, was continued. Work also continued on the digital computer analysis of the dynamic response of pressure transducers to shock inputs. A study was made of the accuracy of heat transfer measurements with water cooled flush diaphragm pressure transducers. Attention was given to transducer mounting and installation problems, especially gaskets and sealing. R.N.A.

N66-21363# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GYROSCOPIC SYSTEM WITH CANTED ROTORS AND TWO DEGREES OF FREEDOM
V. V. Maksimov 9 Mar. 1965 13 p Transl. into ENGLISH from Tr. Kazansk. Aviats. Inst. (Kazan), no. 75, 1963 p 61-69
(FTD-TT-64-856/1+2; AD-612412) CFSTI: HC $1.00/MF $0.50

A description of a gyro system with two degrees of freedom, and with inclined rotors, which possesses the property of stabilizing itself in an identical way around the axis of revolution of the base as an ordinary gyroscope with two degrees of freedom. The individual movability of each of the gyroscopes on a common base with the presence of its inclinations changing with regard to the axis of rotation. The sign of the value of the measurable angular velocity is taken from one gyroscope. The second gyroscope can be used as a pickup of the angular velocity in the systems of stabilization and automatic control of flying apparatuses or as a cutout of the correction of the gyro instruments. The setting of the pointer on the indicated gyroscopes assures the observation of the position of the axis and the direction of revolution. The instrument will measure the resulting angular velocity of all revolutions the vectors of which line in the plane YOZ. Author (TAB)

N66-21364# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AUTOMATIC GAMMA FLAW DETECTOR
A. V. Dzhabadari and Ya. R. Khvedelyani 7 May 1965 6 p Transl. into ENGLISH from Soviet Patent No. 153139 (Appl. no. 737340/25 8 Jul. 1961) 3 p
(FTD-TT-64-1381/1+2; AD-615992) CFSTI: HC $1.00/MF $0.50

The invention is an automatic gamma flaw detector with a protecting container, holding radioactive preparations of varying intensities. The ampoules are fastened on the ends of flexible lines and wound onto drums mechanically connected to an electric motor which is controlled by turning the drums. A throw-over adaptation device serves for shifting a roller axially over the drum in order to link the shaft of the motor with the respective drums. TAB

N66-21373# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
ACTIVE ACOUSTIC DEVICES Interim Report, 1 Apr.–30 Jun. 1965
W. H. Brendecke, N. G. Sakiotis, and F. S. Hickernell Griffiss AFB, New York, RADC, Feb. 1966 67 p refs
(Contract AF 30(602)-3478)
(RADC-TR-65-390; AD-628450) CFSTI: HC $3.00/MF $0.75

Thin film transducer techniques have yielded conversion losses of 6 to 8 db with bandwidths of the order of 50% in the frequency range of 100 to 300 megacycles. Surface roughness and pinholes have caused major interface problems between the transducer and the drift field contacts. The dependence of RF performance upon crystal length and lateral dimensions and the dependence of crystal temperature upon cross section were investigated. The electrical and acoustic parameters which characterize a strong electroacoustic gain interaction are summarized. A correlation between the gain properties of a sample and its etch pit density was determined. Author (TAB)

N66-21381# Naval Radiological Defense Lab., San Francisco, Calif.
CALCULATED RESPONSE OF AIR-WALL DOSIMETERS OR GEIGER-MUELLER TUBES TO MONOENERGETIC PHOTONS BETWEEN 1 AND 10 MeV
A. Redmond 13 Dec. 1965 28 p refs
(USNRDL-TR-944; AD-626998) CFSTI: HC $2.00/MF $0.50

The question of registering dose from weapon and reactor photons of 2 to 10 MeV energy has led to a study of the capability of conventional dosimeters and Geiger Mueller tubes to respond accurately to these energies. The cases are analyzed of 1/16-in. and 1/8-in. air wall dosimeters under bombardment with these high energy photons, and also under bombardment with these photons plus the electron flux density coming from an air absorber of sufficient thickness to ensure primary to secondary radiation equilibrium. Dosimeters of two different wall thicknesses, 2.5 and 5 grams-sq cm, are studied, the latter of which can reach primary-to secondary equilibrium under 10 MeV photons (and, of course, under all lower energies). The attenuation of the primary flux density is relatively small even at the larger thickness. The results given in tables and a graph show that the thin wall dosimeters will give a distorted indication of dose at higher energies. The chamber with 5 grams per square centimeter wall responds in constant ratio to the response of the ideal air wall chamber for photons from 1 to 10 MeV and car therefore be used under all conditions for a register of dose TAB

N66-21403# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf, (Austria). Reaktorzentrum
ON A NEW NON-MAGNETIC DYNAMIC MASS SPECTROMETER [UBER EIN NEUES MAGNETLOSES DYNAMISCHES MASSENSPEKTROMER]
M. J. Higatsberger, F. Rudenauer, and F. P. Viehbock 1966 19p refs In GERMAN Submitted for Publication
(SGAE-PH-39/1966) CFSTI: HC $1.00/MF $0.50

Construction and quantitative working analysis of a radio-frequency mass spectrometer prototype is discussed that utilized a special arrangement of high frequency fields and drifting zones to obtain high energy resolutions from passing ion trajectories. The time dependency rate of the detector current gives the mass distribution value for the different ions and their needed velocity to travel a linear trajectory. This apparatus has a resolution capacity of about 200, is comparatively small, and needs little electronic input. G.G.

N66-21455# Scope, Inc., Falls Church, Va.
APPLICATION OF TIME-DOMAIN ANALYSIS TO PRENORMALIZATION OF RECONNAISSANCE PHOTOGRAPHY Final Technical Report, 19 Jun. 1964–23 Jul. 1965
Malcolm R. Uffelman and Warren L. Holford Griffiss AFB, N. Y., RADC, Jan. 1966 146 p refs
(Contract AF 30(602)-3454)
(RADC-TR-65-301; AD-627899) CFSTI: HC $4.00/MF $1.00

This is a study of the integral-scan parameter-generator and electrical property filtering in determining unique target signatures. The report includes the details of the construction and operation of an improved integral scanner with adjustable property filters, and presents an evaluation of the scanner-processor system using aerial target imagery. A brief experimental evaluation of the integral-scan, time domain prenormalizer was conducted. The test results obtained indicate that the measurements made by the prenormalizer are descriptive of the imagery under view and that the measurements have a high degree of invariance to translation and rotation.
Author (TAB)

N66-21476# General Precision, Inc., Little Falls, N. J.
STELLAR ACQUISITION FEASIBILITY FLIGHTS (STAFF). VOLUME II: TECHNICAL Program Progress Report No. 35, Jan. 1966
15 Feb. 1966 9 p
(Contract AF 04(694)-327)
(GPI-311.1-1057, Vol. II; AD-627878) CFSTI: HC $1.00/MF $0.50

Progress is reported on the status of the Stellar Acquisition Feasibility Flights /STAFF/ Program. Data is presented on management schedules, equipment engineering, flight test operations, logistics, and reliability. M.R.W.

N66-21518# Army Foreign Science and Technology Center, Washington, D. C.
PHOTOGRAMMETRIC PARAMETERS OF A CAMERA
G. V. Romanovskiy Dec. 1965 19 p refs Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), Jul. 1964 p 34–46
(FSTC-381-T65-675; AD-627917) CFSTI: HC $1.00/MF $0.50

The photogrammetric parameters of a camera are understood to be those constants which must be known in carrying out photogrammetric operations on photographs obtained by using this camera. In this article, the requirements are considered for determining the camera parameters with a veiw especially toward those methods of stereophotogrammetric photographing which are the most accurate. TAB

N66-21533 Office of Naval Research, Washington, D. C.
PERSPECTIVES IN BIO-TELEMETRY
S. R. Galler *In its* Third Conf. on the Navy Microelectron. Program [1965] p 51–56 refs (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

Biological scientists, especially those engaged in field research, have urgent requirements for a variety of electronic instrumentation that will enable them to detect biological and related environmental parameters, measure these parameters with appropriate precisions and accuracies, and either store the information or transmit it back to research centers on a real-time basis. Field biologists must be able to probe the depths of the oceans with sufficiently reliable instrumentation to

warrant the large expenditure of time and money needed to "field" a biological sciences expedition. Author

N66-21534 American Electronic Labs., Inc., Lansdale, Pa.
ADVANCEMENTS IN ANIMAL TELEMETRY
Winston H. Starks *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 57–61 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

The role of microelectronics is presented as it relates to biological instrumentation for data acquisition and telemetry of ecological parameters. The miniaturization of present and future instrumentation is discussed, along with the significant advantages which microelectronics can provide in the expansions of applications as well as the improvement of data accuracy in ecological monitoring devices. Author

N66-21580 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIO-FREQUENCY MASS SPECTROMETER FOR THE "ELEKTRON" SATELLITES
B. I. Zarkhin, V. G. Istomin, A. E. Rafal'son, and M. Ye. Slutskiy *In its* Cosmic Res., Vol. 3, No. 5 20 Jan. 1966 p 167–189 refs (See N66-21566 11-30) CFSTI: HC $6.00/MF $1.25

A miniature mass spectrometer designed for measurement of ionic and neutral atmospheric composition aboard satellites is described. A special feature of the instrument is its use of the alternating decelerating potential mode, which makes it largely insensitive to the degasification background (in the range of mass numbers from four to 34 absolute mass units) and prevents registration of spurious mass peaks. The device has a range of one to 34 absolute mass units and a resolution of the order of 20 in the region M=20. Its sensitivity is of the order of 10−3 in the ion-analyzer regime and of the order of 1·10−10 mm Hg in the neutral-composition analyzer regime. Author

N66-21598# Chemical Lab. RVO-TNO, Rijswijk (Netherlands).
AN APPARATUS FOR THE AUTOMATIC DETERMINATION OF THE PENETRATION TIME [EEN APPARAAT VOOR DE AUTOMATISCHE BEPALING VAN DOORSLAGTIJDEN]
F. H. Meppelder Dec. 1965 17 p refs *Its* Rept.-1965/13 (TDCK-44553) CFSTI: HC $1.00/MF $0.50

An apparatus is described which permits penetration experiments on charcoal to be performed automatically and self recording. The apparatus warns by means of a buzzer as soon as the concentration of the test gas in the carrier stream after the sample exceeds a predetermined level. Detection is accomplished by a hot-electrode cell. After the discussing of the properties of a commercial specimen, a self-constructed detector is described. The detector is not quantitative but is well suited to our purpose. The sensitivity of the detector is so high and the concentration of the test gas increases so rapidly after penetration, that the point of inflection in the concentration-time curve can be determined sufficiently accurate. Further work in this field will comprise the construction of a hot-electrode cell with platinum as sheath material, the incorporation of a cathode-follower circuit in the measuring unit and the construction of a simple cheap flame ionization detector for quantitative work. Author

N66-21600# Central Lab. for Radiological Protection, Warsaw (Poland).
RADIATION DOSE SENSITIVE POCKET ALARM MONITOR [KIESZONKOWY SYGNALIZATOR PRZEKROCZENIA DAWKI PROMIENIOWANIA GAMMA]
B. Bukowiecki 1965 11 p refs In POLISH; ENGLISH and RUSSIAN summaries
(CLOR-43/D) CFSTI: HC $1.00/MF $0.50

The dose sensitive pocket alarm monitor for use by members of emergency crews is presented. The instrument containing an ionization chamber, an electrometer tube and a signal generator is supplied from battery. The instrument gives an acoustic alarm when a dose of 300 mr is accumulated. Author

N66-21625# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE DEPENDENCE OF DOSIMETER READINGS ON RADIATION HARDNESS
M. N. D'Yachenko and S. K. Puzionovskiy *In its* Early Diagn. of Acute Radiation Sickness 18 Oct. 1965 p 228–235 refs (See N66-21606 11-04) CFSTI: HC $6.00/MF $1.25

The energy dependence of dosimeter readings on radiation hardness is investigated for various dosimeters, which were calibrated by using a Kustner dosimeter. Various curves are presented to show energy dependence for unfiltered X-rays and for those filtered 0.5 and 1.0 mm Cu. Readings for the RIP roentgenometer depend on radiation hardness for filtered radiation; and for the GRI universal roentgenometer this dependence is more marked, especially for filtered radiation with a hardness of 80 to 120 kv. No dependence is shown for filtered radiation of 0.5 mm Cu for a portable condenser dosimeter, although dependence is evidenced here for unfiltered radiation and filtered radiation with 1.0 mm Cu. Such ionization-type dosimeters must, therefore, be calibrated against standard equipment. Use of photoelectric and luminescent dosimeters is also discussed. M.W.R.

N66-21646*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL VIDEO-DATA HANDLING
Robert Nathan 5 Jan. 1966 30 p refs
(Contract NAS7-100)
(NASA-CR-71399; JPL-TR-32-877) CFSTI: HC $2.00/MF $0.50 CSCL 14E

A technique has been developed to perform accurate, detailed operations and analyses upon digitized pictorial data. Television pictures transmitted from the Ranger and Mariner spacecraft have been significantly improved in clarity by correcting those system distortions which affect photometric, geometric, and frequency fidelity. Various classes of structured noise have also been detected and removed digitally by newly devised two-dimensional filters. Although the filters are easier to describe mathematically in the frequency domain, they are more effectively applied as a convolution operation on the original digitized photographs. The cleaned-up, enhanced pictures are used by the computer for further interpretive and statistical analyses. Author

N66-21732# Weapons Research Establishment (Australia).
THE USE OF MAGNETIC TAPE RECORDERS FOR THE PRE-DETECTION RECORDING OF FM SIGNALS
P. O. Gillard [1965] 53 p refs
(WRE-TM-ISD-101) CFSTI: HC $3.00/MF $0.50

The Mincom TIDAX and the Ampex FR1400 recorders are evaluated to determine their performance when used for recording FM signals. A measuring technique is used to separate the errors due to flutter and recording system noise. It is found that the recorders will satisfactorily record data to a bandwidth of DC to 85 kc/s with an rms error of less than 0.125% of full scale data deviation. The application of these recorders at WRE for telemetry purposes is considered in some detail. Author

N66-21739# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
USE FOR THE TRAJECTOGRAPHY OF CLOCKS OF HIGH STABILITY [UTILISATION POUR LA TRAJECTOGRAPHIE D'HOROLOGES A HAUTE STABILITE]
Roland Moreau 1965 19 p refs In FRENCH Presented at a Meeting on Equipment for Firing Ranges, Biarritz, France, 6–10 Dec. 1965
(ONERA-TP-311(1965)) CFSTI: HC $1.00/MF $0.50

High precision clocks, especially atomic clocks, enable us to study new principles of trajectography. Basic research conducted at ONERA in this area enabled us to define the characteristics of clocks to be used and to prepare a series of experiments for localization of a mobile station in space. The results of a first experiment using rubidium vapor clocks are explained and future application is discussed. Author

N66-21792# Federal Aviation Agency, Washington, D. C. Aircraft Development Service.
EVALUATION OF A TAIL LOCATED FLIGHT RECORDER
Paul M. Rich Aug. 1965 27 p
(ADS-50)

The performance of a standard flight recorder, mounted aft of the pressurized bulkhead in the tail section of an air carrier transport aircraft was compared with that of a recorder as presently installed during flight. Flight tests were conducted utilizing the Boeing 720. Two flight recorders and associated accelerometers were mounted in the aircraft; one in the cabin area near the center of gravity and one in the tail of the aircraft outside the pressurized bulkhead. The two recorders were modified to record altitude and airspeed as obtained from an altitude/airspeed transducer located near the pitot-static source. The standard airspeed and altitude channels were supplied by specially installed pitot-static lines running from the nose to the tail of the aircraft. There was no difference between the recordings of the recorder located at the c.g. and the recorder located in the tail for the parameters of airspeed, altitude, and heading. However, there was a difference between the acceleration readings of these recorders. The altitude/airspeed transducer proved more practical. Author

N66-21835# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW US-01 LIGHT AMPLIFIER
5 Nov. 1965 5 p Transl. into ENGLISH from Tekhn. Molodezhi (Moscow), no. 11, 1964 p 22
(FTD-TT-65-708/1+4; AD-627991) CFSTI: HC $1.00/MF $0.50

The intensification of light is accomplished by projecting the image through the objective onto the photocathode of the electron-optical converter of the instrument. Under the action of very feeble light the photocathode radiates electrons. Passing to the anode they, with the aid of an electron-magnetic lens are focused onto a luminescent screen. The illumination of the image is amplified. Afterward it falls on the photocathode of the following chamber and occurs several times until the required brightness is attained. TAB

N66-21837# Navy Dept., Washington, D. C.
A NUCLEAR MAGNETOMETER FOR MEASURING HIGHLY NON-UNIFORM MAGNETIC FIELDS [YADERNYY MAGNITOMETR DLYA IZMERENIYA SIL'NO NEODNORODNYKH MAGNITNYKH POLEY]
D. P. Vasilevskaya and L. V. Vasil'yev 1966 7 p refs Transl. into ENGLISH from Instr. and Exptl. Tech. (USSR), no. 1, 1965 p 174–177
(TT66-60481; AD-627824) CFSTI: HC $1.00/MF $0.50

A description if given of a nuclear magnetometer used for making precision measurements of magnetic fields with gradients of up to 1,000 to 3,500 oersteds/centimeter. The results of calculations for a field for two types of current quadrupoles creating a compensating gradient within the volume of an ampoule with the 'working medium' are given. Author (TAB)

N66-21841# CTS Corp., Elkhart, Ind. Research and Development Div.
PRODUCTION ENGINEERING MEASURE FOR SUBMINIATURE, TRANSISTOR TYPE POTENTIOMETERS Quarterly Progress Report, 1 Apr.–30 Jun. 1965
C. L. Holmes and D. C. Kinsey [1965] 12 p
(Contract DA-36-039-85976)
(QPR-16; AD-627413) CFSTI: HC $1.00/MF $0.50

1,800 samples were fabricated and tested to Technical Requirement SCS-112. These units did not satisfactorily perform all of the specified requirements. 1,600 controls were refabricated and retested in an attempt to meet those test requirements which were not met on the first 1,800 group. After completion of the second test group, test specifications of Technical Requirement SCS-112 had still not been satisfactorily met on moisture resistance testing on the 50 ohm controls of both styles and rotational life testing on the 25,000 ohm bushing mount style. Because these two test requirements are beyond the present state of the art, Technical Action Request No. 8 was submitted to request a change in test requirements. These requested changes were denied. These requests were then submitted to the contracting officer for judgment. Author (TAB)

N66-21847# Royal Aircraft Establishment, Farnborough (England).
AN AC BRIDGE TRANSISTOR AMPLIFIER, WITH DOUBLE INTEGRATION FOR USE WITH INDUCTANCE TRANSDUCERS
A. H. Smith and L. F. Silvester London, Min. of Aviation, Jan. 1961 23 p refs
(RAE-TN-INSTN-170)

The design of a six channel AC bridge amplifier, together with its associated 2 Kc/s bridge supply oscillator, is described. Semi-conductors have been used throughout, and a comparison is drawn with previous equipment using thermionic valves. The equipment is designed to work with push-pull inductance accelerometers, and either mirror galvanometer recorders or magnetic tape recorders. Double integration with respect to time is provided so that the amplitude of the output signal is proportional to displacement of the transducer from a few cycles per second to 100 cycles per second. The use of semi-conductors has resulted in a much smaller and lighter equipment, a marked saving in input power, and a worthwhile improvement in the performance of the complete measuring system. Author

N66-21849# Block Engineering, Inc., Cambridge, Mass.
WAVEFRONT FOLDING INTERFEROMETER Final Report, Sep. 1, 1963–Feb. 28, 1965
Robert L. Whalen 25 Jan. 1966 32 p refs
(Contract AF 19(628)-3314; ARPA Order 450)
(AFCRL-66-94; AD-628784) CFSTI: HC $3.60/MF $0.50

Results of a design study of a wavefront folding interferometer were applied to the fabrication of a prototype interferometer which was experimentally employed to make angular diameter measurements of missile re-entries. The interferometer, based on a modification to Lloyd's mirror, displays the space frequency Fourier transform, including both amplitude and phase, of an incoherently illuminated object. Because the wavefront folding interferometer provides a direct positional reference, this instrument was used in the field to provide a measure of both apparent angular diameter and tracking error. The field instrument consists of a 14 cm collector telescope, a wavefront folding interferometer, and an 8 mm camera to record the fringe pattern. During the experimental program carried out on the Pacific Missile Range, the interferometer was installed on a Roti optical tracking mount. Because of the extreme pointing sensitivity of the instrument and the relatively crude tracking provided, difficulties were encountered which would be absent with more accurate tracking. Use of the folding interferometer to measure the apparent diameter of a time varying source such as a reentry body is deemed a promising technique worthy of further investigation.
Author (TAB)

N66-21856# United Kingdom Atomic Energy Authority (Culham (England). Research Group.
THE MEASUREMENT OF TEMPERATURE IN THE RANGE 3°K TO 80°K USING CARBON RESISTORS
D. H. J. Goodall Sep. 1965 22 p refs
(CLM-R-47) HMSO: 2s 6d

The low temperature characteristics of some commercial carbon resistors are obtained using a vapor pressure thermometer as a standard. The temperature characteristics calculated from three resistance measurements near 4°K, 20°K, and 77°K give a good approximation to the experimentally determined characteristics. The stability of the resistors improves with time and thermal cycling, and is better than ±1% at 4.2°K and 77°K.
Author

N66-21895# Army Electronics Labs., Fort Monmouth, N. J.
PINHOLE ARRAY CAMERA FOR INTEGRATED CIRCUITS
Phillip A. Newman and Vincent E. Rible Jan. 1966 19 p refs
(ECOM-2653; AD-628485) CFSTI: HC $1.00/MF $0.50

A pinhole camera for the production of multiple images for integrated circuits, consisting of an array of precisely positioned uniform diameter pinholes and a vacuum back to hold the film or plate, has been designed, fabricated, and tested. This camera was designed to replace the step-and-repeat camera method of producing multiple images that is presently used. The two basic requirements for repetition of circuit patterns are the achievement of high image quality and precise registration between all the masks in a set. The arrangement discussed here permits lines of .0005" width in the final working mask with precise registration.
Author (TAB)

N66-21897# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASURING DEVICES
L. S. Kuznetsova and A. Ye. Matveyeva 24 Sep. 1965 595 p refs Transl. into English of the book "Izmeritel'nyy Instrument" Moscow, Gos. Izd. Standarty, 1963 488 p
(FTD-TT-65-314/1+2; AD-628310) CFSTI: HC $8.95/MF $2.50

The 'Measuring Devices' handbook has been compiled by the State Standard Publishing House and includes standards effective on May 1, 1963. Due to the fact that standards are regularly revised and revisions are introduced, the standards should be checked when using the handbook to find out whether there have been any revisions. Standards which have the * sign at the number include all introduced revisions as of May 1, 1963.
Author (TAB)

N66-21985# United Kingdom Atomic Energy Authority, Harwell (England). Research Group.
POSITION FINDING COUNTER FOR THE BUECHNER MAGNET
W. Melzar and F. Puehlhofer Jul. 1965 21 p refs Transl. into ENGLISH from GERMAN *Its* Rept.-1965/V/2
(NP-TR-1302)

Silicon surface barrier detectors for determining simultaneously the energy of the incident particle and the position of impact are described. The counters are used for arranging the focal plane of the Buechner magnetic spectrograph. The principle of the counter and a calculation of position resolving power are given. Experiments are described which illustrate the testing and application of position finding counters. The arrangement of the Buechner spectrograph is discussed.
Author (NSA)

N66-22022# Atomics International, Canoga Park, Calif.
CALIBRATION OF S10A RADIATION DETECTION SYSTEMS
J. Lowenson and A. Chesavage 19 May 1965 36 p
(Contract AT(11-1)-GEN-8)
(NAA-SR-MEMO-11333) CFSTI: HC $2.00/MF $0.50

The high level neutron and gamma systems were calibrated such that the calculated flux rates will result in a mid-scale reading. The same setting was intended for the low level neutron system, but during system calibration the output from two systems was consistently a factor of 4 low. The discrepancy is believed to be due to improper setting of the discriminator which was inaccessible for adjustment. It appears that the low level neutron system, as is, will provide usable data. From the calibration data of the four high level neutron systems the responses of the two HLNS's on FS-4 and FS-5 were calculated.
Author (NSA)

N66-22047# Bettis Atomic Power Lab., Pittsburgh, Pa.
REMOTELY OPERABLE TOOLMAKER'S MICROSCOPE
L. M. Behr and J. D. Eichenberg May 1965 9 p Submitted for Publication
(Contract AT(11-1)-GEN-14)
(WAPD-T-1690) CFSTI: HC $1.00/MF $0.50

A toolmaker's microscope was adapted for remote use in a hot cell for measuring the distances between fiducial marks on irradiation samples. Closed-circuit television was used as the viewing method. Optimum conditions, accuracy, and operating experience are discussed.
NSA

N66-22057# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.
MINIATURE NEUTRON DETECTOR DEVELOPMENT Quarterly Progress Report, 1 Apr.–30 Jun. 1964
J. Weisman, ed. 15 Jul. 1964 17 p refs
(Contract AT(30-1)-2827)
(WCAP-2644; EURAEC-1150) CFSTI: HC $1.00/MF $0.50

Work has continued on the development of silicon carbide diodes for the detection of neutrons under sustained high-temperature, high-flux conditions. A technique was developed for evaporating a thin film of ^{235}U on the surface of

the diode. Diodes so processed successfully counted fission fragments produced by exposure to a neutron source. The greatest emphasis during this period has been placed on the preparation of a high temperature mounting for counting diodes. Such a mounting will allow the entire assembly to be repeatedly heated to temperatures up to 1300°C. It is expected that this will allow substantial annealing of irradiation damage. Configurations which successfully withstand this thermal cycling have been developed but units so processed have shown a very poor α counting ability. Author (NSA)

N66-22062# California Univ., Berkeley. Lawrence Radiation Lab.
STATUS AND FUTURE PLANS FOR LRL FLYING SPOT DIGITIZER
Howard S. White Jul. 1965 17 p refs Presented at Conf. on Instrumentation for High Energy Phys., Lafayette, Ind.
(Contract W-7405-ENG-48)
(UCRL-16286; CONF-650510-13) CFSTI: HC $1.00/MF $0.50

A review of Berkeley's Flying Spot Digitizer FSD system and its operational components is presented. The FSD consists of a Hough-Powell Device attached online to an IBM 7090 II computer having two cores, discs, and five channels. Measurement times are given for various bubble chambers. Several new developments with the FSD are reported. NSA

N66-22067# California Univ., Berkeley. Lawrence Radiation Lab.
THE USE OF SEMICONDUCTOR DETECTORS FOR INTERNAL-CONVERSION COEFFICIENT MEASUREMENTS
J. M. Hollander May 1965 9 p refs Presented at the Intern. Conf. on the Internal Conversion Process, Nashville, Tenn.
(Contract W-7405-ENG-48)
(UCRL-16035; CONF-650525-8) CFSTI: HC $1.00/MF $0.50

The application of silicon and germanium detectors for measurement of internal-conversion coefficients is discussed. Data taken by the semiconductor method are used to print out the capabilities of this new method. Some advantages over previous methods are discussed. NSA

N66-22075# Sandia Corp., Albuquerque, N. Mex.
APPLICATION OF ELECTRON MICROSCOPY IN DIMENSIONAL METEOROLOGY
W. B. Estill and J. C. Moody [1965] 19 p refs Presented at the 20th Ann. Conf. of the Instr. Soc. of Am., Los Angeles, 20 Jul. 1965
(Contract AT(29-1)-789)
(SC-DC-65-1589; CONF-651002-3) CFSTI: HC $1.00/MF $0.50

The amount of plastic deformation caused by a Talysurf stylus as it is traced across a thin gold film can be determined by the use of electron microscopy. In this experiment, variables were introduced that caused changes in the magnitude of plastic deformation from 50 Å to 490 Å. The study indicated that the damage to a thin film of soft gold can probably be limited to about 100 Å if appropriate precautions are taken. Author (NSA)

N66-22082# Washington Univ., Seattle.
CALIBRATION OF A SILICON SURFACE-BARRIER DETECTOR TO READ NEUTRON DOSE INDEPENDENT OF INCIDENT NEUTRON ENERGY
Alfred John Ahlquist (M.S. Thesis) 1965 42 p refs
(TID-21844) CFSTI: HC $2.00/MF $0.50

A Si surface-barrier detector with a LiF foil was calibrated for reading neutron doses independently of both the neutron energy and the associated gamma radiation. The 10-inch polyethylene sphere, used to moderate the neutrons, was found to give a response similar to the inverse of the Radiation Protection Guide curve. The sensitivity and lifetime of the detector are discussed. NSA

N66-22091# California Univ., Berkeley. Lawrence Radiation Lab.
HEAT TRANSFER CONSIDERATIONS IN DIFFERENTIAL CALORIMETER DESIGN
Patrick Stephen Nicholson (M.S. Thesis) 31 Aug. 1965 72 p refs
(Contract W-7405-ENG-48)
(UCRL-16336) CFSTI: HC $1.00/MF $0.50

Following early work on the development of a differential thermal calorimeter, an attempt was made to eliminate the sources of error inherent in these designs. Previous designs are discussed and criticized in detail, and a set of conditions postulated necessary for accurate work. Following these conditions, a series of modifications of apparatus design are reported. Heat transfer conditions in each system were investigated and are discussed. From these results, an ideal design is proposed which is based primarily on heat flow through packed powders. Author (NSA)

N66-22101 Princeton-Pennsylvania Accelerator, Princeton, N. J.
BUBBLE CHAMBER MEASUREMENTS ON-LINE TO A PDP-5 PDP-1 SYSTEM
M. Bazin, J. Benoit, H. Blumenfeld, U. Nauenberg, and R. Zacher 19 May 1965 8 p Presented at the IEEE Meeting, Purdue Univ., Lafayette, Ind., 12–14 May 1965 Submitted for Publication
(Contract AT(30-1)-2137)
(PPAD-2137-549; CONF-650510-5) CFSTI: HC $1.00/MF $0.50

An on-line measuring system was designed for 10 measuring machines. A 12K 12-bit word PDP-5 computer is the central unit of the system. It performs all logical checks permitted on the data from the given parameters and labels for each event. A fast data link between the PDP-5 and a PDP-1 computer gives the possibility of on-line geometrical reconstruction in the PDP-1. A measuring station can give 10 commands to the computer besides sending data, and the computer can give 14 replies in the form of error lights. The data is formated for THRESH input by the PDP-5 and put on an incremental tape recorder in a form directly readable by a 7094 computer. Author (NSA)

N66-22111# Aeroprojects, Inc., West Chester, Pa.
APPLICATIONS OF ULTRASONIC ENERGY: ULTRASONIC INSTRUMENTATION FOR NUCLEAR APPLICATIONS Bimonthly Progress Report No. 23, 1 Jun.–31 Jul. 1965
Aug. 1965 10 p refs
(Contract AT(30-1)-2910)
(NYO-2910-11) CFSTI: HC $1.00/MF $0.50

An instrument for the determination of proximity to boiling was constructed in accordance with specifications set up by Oak Ridge National Laboratory. Preliminary tests were conducted prior to installation in a pool-boiling capsule. NSA

N66-22138# Oak Ridge National Lab., Tenn.
RECENT DEVELOPMENTS IN THE PROTON-RECOIL SCINTILLATION NEUTRON SPECTROMETER
W. R. Burris and V. V. Verbinski [1964] 38 p refs Presented at the Am. Nucl. Soc. Meeting, San Francisco, Nov.–Dec. 1964
(Contract W-7405-ENG-26)
(ORNL-P-1110; CONF-654-89) CFSTI: HC $2.00/MF $0.50

Details of the pulse-shape discrimination circuit (for rejecting gamma background) and of the unscrambling code (to resolve the problem of poor line shape) used in a proton-recoil scintillation neutron spectrometer are discussed. Characteristics of the NE-213 and stilbene scintillators and of the pulse-shape discriminator operation are described. The FERDO program for unfolding instrument response is described, including the FERDO viewpoint of inequality constrained estimation, estimation of the statistical confidence region, the minimization scheme, and transformation matrix calculation. A listing of the FORTRAN-IV/FORTRAN-63 programs for FERDO and a subroutine GINV is given. Sample results are shown for pulse-height spectra from the $^{9}Be(\alpha,n)^{12}C$ reaction at 7.3 and 10.1 Mev and from the beam from the ORNL tower shielding reactor.
NSA

N66-22155# Del Electronics Corp., Mount Vernon, N. Y.
STRATOSPHERIC AEROSOL SAMPLING Semiannual Progress Report, Sep. 1964–Feb. 1965
L. R. Solon, comp. 10 May 1965 26 p
(Contract AT(30-1)-2363)
(NYO-2363-3) CFSTI: HC $2.00/MF $0.50

The 37-tube Model II Electrostatic Precipitator was developed for sampling stratospheric aerosols at a rate of 1850 ambient cfm at altitudes of 105,000 to 150,000 feet. Work on the following equipment is described: ion-tracer flowmeter, sample recovery system, and self-regulating d-c power supply. A proposed flight program for testing the precipitator is described.
NSA

N66-22199*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A DEMODULATION SYSTEM FOR VECTOR MEASUREMENTS FROM A SPINNING SATELLITE
William J. Kerwin and Robert Munoz [1965] 16 p ref Presented at the IEEE Symp. on Signal Transmission and Processs., New York, 13–14 May 1965
(NASA-TM-X-56524) CFSTI: HC $1.00/MF $0.50 CSCL 09F

A method is presented for demodulating spin-modulated data from magnetometer sensors mounted on a spinning satellite. The system allows direct interpretation of data frequencies below, at, and above the spin frequency. The limitations imposed by simple demodulators is discussed and it is suggested that these limitations may be eliminated by the use of the proposed two-phase demodulator system. A mathematical description of the system is provided, block diagrams of the system are shown, and samples of demodulated waveforms are included.
H.S.W.

N66-22322# Advisory Group for Aerospace Research and Development, Paris (France).
SELECTED IN-FLIGHT INSTRUMENTATION PAPERS FROM AGARD FLIGHT MECHANICS PANEL, TWENTY-SIXTH MEETING
Jun. 1965 70 p refs Meeting held in Paris, Jun. 1965
(AGARD-506) CFSTI: HC $3.00/MF $0.75

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3. THE ROLE OF TELEMETRY IN MODERN IN-FLIGHT MEASURING TECHNIQUES A. Becker (Deut. Forschungsanstalt für Luft- und Raumfahrt) p 43–62 (See N66-22325 11-7)

N66-22323 Aeroplane and Armament Experimental Establishment, Boscombe Down (England).
APPLICATION OF AIRBORNE DIGITAL RECORDING AT A&AEE
R. P. Dickinson and R. T. Shields *In* AGARD Selected In-Flight Instrumentation Papers from AGARD Flight Mech. Panel, 26th Meeting Jun. 1965 p 1–15 (See N66-22322 11-14) CFSTI: HC $3.00/MF $0.75

The paper reviews experience in the application of in-flight digital recording to the flight testing task, which is primarily that of acceptance testing. Types of data required to be recorded, and the preferred use of well tried instrumentation techniques where possible, are noted. Digital recording has so far only been applied to navigation trials, where it has been considered justified by special needs such as high accuracy, high data rate, and the associated data processing requirements, or the use of digital techniques in the equipment being tested. Some account is given of the digital instrumentation systems which have been used and of the experience obtained with them.
Author

N66-22324 Centre d'Essais en Vol, Bretigny-sur-Orge (France).
FRENCH MEANS OF MEASUREMENT FOR FLIGHT TESTS [LES MOYENS DE MESURE FRANCAIS POUR LES ESSAIS EN VOL]
G. Petit *In* AGARD Selected In-Flight Instrumentation Papers from AGARD Flight Mech. Panel 26th Meeting Jun. 1965 p 17–41 In FRENCH; ENGLISH summary (See N66-22322 11-14) CFSTI: HC $3.00/MF $0.75

There is at present a rapid evolution of requirements in the field of measures for flight tests, which calls for a thorough reshaping of instrumentation techniques. After a brief review of the recording systems applied at the flight test center and having analyzed the main problems existing at present, this document goes on to show the major directions chosen for the evolution of the French means of measurement.
Author

N66-22339* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MEASUREMENT OF GAS TEMPERATURE AND THE RADIATION COMPENSATING THERMOCOUPLE
Glenn E. Daniels *In its* Aero-Astrodyn. Res. Rev. No. 3 [illegible] Oct. 1965 p 72–84 refs (See N66-22329 11-34) CFSTI: HC $4.00/MF $1.00

To achieve a high degree of accuracy in gas temperature measurement, a method is devised whereby several thermocouples may be wired together to make the radiation compensating thermocouple. This thermocouple is designed so that the errors of measurement from the radiation environment will cancel out; results of tests, equations, and information are presented to aid in its fabrication.
Author

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N66-21121# Naval Research Lab., Washington, D. C.
A NEW APPROACH TO LUBRICATING BALL BEARINGS Interim Report
V. G. Fitz Simmons, C. M. Murphy, J. B. Romans, and C. R. Singleterry 28 Dec. 1965 25 p refs
(NRL-6356; AD-627345) CFSTI: HC $1.00/MF $0.50

A study was undertaken of the causes of unsatisfactory service and storage life of Navy synchros and servo motors. Silicone oils have been in wide use as the lubricant for the ball bearings of these devices because of the good low-temperature characteristics of these materials. Examination of bearings from synchros which failed qualification tests gave evidence of fretting corrosion, broken bearing retainers, dry residues, and loss of lubricant. A white flocculent substance was found in new silicone-lubricated bearings. This substance could be reproduced in the laboratory at room temperature when rubbing ferrous metals were lubricated with silicones. The principal cause of early synchro and servo motor bearing failure is believed to be the creeping away of the small supply of silicone lubricant from the load-carrying area of the bearings under service and storage conditions. Studies proved that a lubricant based on bis(2-ethylhexyl)azelate satisfactorily lubricated synchro bearings at temperatures as low as −55°C. Creeping of lubricants composed either of the azelate ester or of silicones from ball bearings was prevented by the use of low-energy fluorochemical barrier films. The life of synchros containing bearings treated with the barrier film and lubricated with a bis(2-ethylhexy)azelate composition has increased from 300 hours to nearly 4,000 hours on standard qualification tests. TAB

N66-21176# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
SURVEY OF LITERATURE ON GENERAL MACHINE DESIGN AND CONSTRUCTION [LITERATUUROVERZICHT ALGEMENE WERKTUIGBOUW]
25 Feb. 1966 25 p refs In DUTCH, GERMAN, ENGLISH and FRENCH *Its* Vol. 4, No. AW-31
CFSTI: HC $1.00/MF $0.50

Contains abstracts and bibliographic notes on diese motors, gas turbines and steam turbines, steam plant installation, machine parts and lubrication, materials, measurement and control systems, and technical news.
Transl. by J.O

N66-21178# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
SURVEY OF LITERATURE ON GENERAL MACHINE DESIGN AND CONSTRUCTION [LITERATUUROVERZICHT ALGEMENE WERKTUIGBOUW]
25 Jan. 1966 25 p refs In GERMAN, DUTCH, and ENGLISH *Its* Vol. 4, No. AW-30
CFSTI: HC $1.00/MF $0.50

Contains abstracts and bibliographic notes on diesel engines, gas and steam turbines, steam plant installation, machine parts and lubrication, materials, measurement and control techniques, and technical news. Transl. by J.O.

N66-21233# Atomic Weapons Research Establishment, Aldermaston (England).
ULTRASONIC WELDING (1960–1965) Bibliography
F. M. Woolley and L. Corbett Jan. 1966 31 p refs
(AWRE/LIB/BIB/13) HMSO: 4s

A compilation of abstracts, annotations, and reports on ultrasonic welding is presented. Cited are references on the ultrasonic welding of various metals, steels, refractories, alloys, superalloys, and plastics. References to literature on equipment, machines, instruments, weld techniques, and weld characteristics relative to ultrasonic welding are also included.
M.R.W.

N66-21291# Army Electronics Labs., Fort Monmouth, N. J.
DESIGN PARAMETERS FOR INERT GAS WELDING AND VACUUM BRAZING OF VACUUM COMPONENTS
John J. Sullivan and John B. Schultz Nov. 1965 35 p refs
(ECOM-2651; AD-627466) CFSTI: HC $2.00/MF $0.50

The report describes in detail the commonly encountered fusion welding and vacuum brazing designs for the construction of modern high vacuum components. In the area of fusion welding, the joining of stainless steel tubing to stainless steel flanges, Kovar tubing to stainless flanges, copper tubing to stainless flanges, thin-wall stainless bellows to stainless flanges, butt welding of stainless tubing, and vacuum chamber construction are discussed. The vacuum brazing section includes brazing and feed-throughs to flanges and flange adapters, tubing to flanges, end-caps to tubing and bellows to flange adapters. Author (TAB)

N66-21302# Rock Island Arsenal Lab., Ill. Research and Engineering Div.
MACHINING 18% NICKEL MARAGING STEEL WITH ROTARY TOOLS
Raymond A. Kirschbaum Dec. 1965 36 p refs
(RIA-65-3561; AD-627608) CFSTI: HC $2.00/MF $0.50

Speed and feed combinations for drilling, reaming, tapping and end-milling 18% nickel maraging steel in the annealed condition were determined by laboratory machining tests. Tapping of this material in the maraged (hardened) condition was also successfully accomplished. Comparison of these results with results in the literature and with production data indicate this material may be machined at higher rates than previously recommended. Author (TAB)

N66-21312# National Academy of Sciences—National Research Council, Washington, D. C. Materials Advisory Board.
METALWORKING PROCESSES AND EQUIPMENT Third Progress Report by the Ad Hoc Committee
31 Oct. 1965 32 p refs
(MAB-206-M(3); AD-625049) CFSTI: HC $2.00/MF $0.50

An investigation was made of lubrication in metal working, application of deformation theory to practice, limitations of the extrusion processes, thin sheet rolling. TAB

N66-21347*# Sippican Corp., Marion, Mass.
MAGNET WIRE WELD STUDY Final Report
24 Feb. 1965 87 p Prepared for JPL
(Contract NAS7-100; JPL-950836)
(NASA-CR-71425; R-356A) CFSTI: HC $3.00/MF $0.75
CSCL 13H

An investigation was conducted on the weldability of insulated magnet wire used with contact pins to select the best combination of materials, to develop a welding process, and to recommend welding equipment and automated production

methods. Nickel was selected as the best weldable insulated magnet wire material, as it was the only material that could meet strength and reliability requirements. Formvar was chosen as the insulation material. Methods to penetrate the insulation and make reliable welds were studied. A method was selected which consists of heating the upper electrode causing the Formvar to soften and split under pressure. A test program was established in which 2500 sample welds were pull tested at a 90° angle to the weld, with each sample required to exceed the 50% strength level. Test results are included in the appendix. The use of Formvar coated #34 AWG nickel wire with Alloy 142 pins was recommended as the combination of materials that will weld satisfactorily using operational production line weld equipment with a modification for heating the top electrode. R.N.A.

N66-21362# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WAYS FOR THE AUTOMATION OF NONDESTRUCTIVE WELD-JOINT INSPECTION METHODS
S. T. Nazarov 14 May 1965 12 p Transl. into ENGLISH from Tr. Vsesoyuznoye Obyedinennoye Soveshchaniye po Avtomat. Proizv. Portsessov v Mashinostr. i Avotmatiz. Elektropriyodv v Prom. (Moscow), no. 3, 1962. p 227–232
(FTD-TT-65-50/1+2; AD-615994) CFSTI: HC $1.00/MF $0.50

This article discusses several means of automating nondestructive weld joint inspection methods. Included are descriptions of an X-ray radiation method using an electron-optical converter, an ultrasonic method, and magnetic and electrical methods. R.N.A.

N66-21366# Naval Research Lab., Washington, D. C.
ANALYSIS OF FRICTION TORQUE IN SIMPLE AND PRE-LOADED SPUR GEAR TRAINS Interim Report
James W. Titus 22 Oct. 1965 16 p refs
(NRL-6319; AD-624591) CFSTI: HC $1.00/MF $0.50

The first part of this study develops the relation between the required drive torque and the load torque in a lightly loaded, single gear mesh, considering Coulomb friction between the sliding tooth surfaces. Bearing and windage losses are not considered. All of the load is assumed to be carried on a single pair of teeth, since for lightly loaded gears elastic deflections will be smaller than tooth-to-tooth errors, so that a single pair of teeth may carry the load regardless of the theoretical contact ratio. The use of "efficiency" formulas given in the literature usually gives low values for starting torque requirements. The second part of the study extends the equations to a four-square gear train as representative of preloaded split gear trains, where friction losses are relatively greater than in simple trains. It is demonstrated that the maximum possible friction loss for a given, four-square gear train would occur when and if the two gear meshes simultaneously begin approach action. It is also demonstrated that the friction loss for a gear train using spring-loaded split gears cannot exceed values calculated on the assumption that one mesh begins approach action while the other mesh terminates recess action. Author (TAB)

N66-21397# Rock Island Arsenal Lab., Ill. Manufacturing Technology Div.
PICTORIAL JOURNAL OF EDM–ECM
Jul. 1965 159 p refs
(AD-622814) CFSTI: HC $5.00/MF $1.00

A pictorial journal of the electrical discharge machining and electro chemical machining processes is presented. A brief historical background and description of these processes is included. EDM and ECM applications are a solution to machining materials which cannot be economically machined by conventional methods. EDM and ECM applications are a solution for the machining of heat-treated metals, exotic metals, and special alloys which are impossible to machine by conventional methods. EDM and ECM applications are a solution to machining geometrical configurations which otherwise would have to be partially machined then hand worked. EDM and ECM applications are a solution to machining without mechanical or thermal distortion. EDM and ECM applications are a solution to machining dies in a single piece configuration, thereby eliminating segmentation. EDM applications are a solution to obtaining servo-port shapes and contours that were either impossible before or were impractical from the standpoint of cost and/or bushing rigidity, and alignment problems. EDM has several features that lend it to production work. It can cut any die material at a cost as low as that for steel dies. Worn surfaces of forging dies usually do not require finishing; the die can be taken directly from the machine to the forge hammer. Since the electrode moves into the work automatically, machines can be left unattended for long periods of time. Technological advances have elevated these processes to a production basis. Author (TAB)

N66-21415# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CRITERIA OF SIMILARITY IN CENTRIFUGAL PUMPS
E. A. Vasil'tsov 30 Sep. 1965 17 p refs Transl. into ENGLISH from Energomashinostroenie (Moscow), no. 10, 1964 p 12–14
(FTD-TT-65-911/1+2+4; AD-622460)

A conclusion concerning the criteria of similarity in centrifugal machines is examined. The connection between these criteria and the high-speed factors is proven. Empirical dependences of the criteria of pressure and output depending on the high-speed factor are introduced. Author (TAB)

N66-21416# International Business Machines Corp., Poughkeepsie, N. Y.
CRYOGENICS MEMORY PLANE INTERCONNECTION TECHNIQUES Final Report, 20 Jan. 1964–12 Feb. 1965
J. Rosenberger, A. B. Lindquist, and R. Seeber Griffiss AFB, N. Y., RADC, Oct. 1965 230 p refs
(Contract AF 30(602)-3344)
(RADC-TR-65-149; AD-622819) CFSTI: HC $6.00/MF $1.25

Several factors which are key to the success of a Cryotron Associative Processor (CAP) were studied in detail. CAP control circuits and several types of comparator cells were built and tested. Intraplanar coupling techniques were evaluated and a low inductance method was successfully demonstrated. Ladder circuit resolution times were theoretically analyzed and the analysis confirmed experimentally. A three-plane model was built with partial success. A tester was built with a two-fold purpose: (a) to exercise the model in an associative manner, (b) to evaluate the adequacy of the system design resulting from the use of the simple comparator cell. Author (TAB)

N66-21434# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILIZATION OF ARC BURNING PROCESS (AC-ARC) AT ARGON-ARC WELDING ON STRUCTURAL STEEL STEEL

A. G. Simonik 28 Jul. 1965 13 p Transl. into ENGLISH from Svarochnoye Proizvodstvo (Moscow), no. 3, 1965 p 29–30 (FTD-TT-65-536/1+2+4; AD-619319) CFSTI: HC $1.00/MF $0.50

Data are presented on the stabilization of arc burning process of an ac arc of industrial higher frequency by chemical oxidation of basic metal and filler wire, and also by adding oxygen to the argon. Author (TAB)

N66-21442# Linden Labs., Inc., State College, Pa.
MACHINING HIGH PURITY ALUMINA Quarterly Report, Apr. 1–Jun. 28, 1965
P. A. Marshall, Jr. and H. L. Brungard 28 Jul. 1965 28 p (Contract DA-36-039-AMC-03634(E))
(QR-4; AD-628013) CFSTI: HC $2.00/MF $0.50

The report describes the machinability of two commercial grade polycrystalline aigo purity alumina bodies, a 94% and a 96% alumina, after being rendered friable as a result of immersion in 52% aqueous hydrofluoric acid as a function of time. It was found that in performing those machining operations where a single point tool was required, selected grades of carbide tooling were preferred to diamond single point tooling. The report covers the required machining operation with critical analysis of such parameters as feed, speed, machine time, redressing tool time and an estimated rate of output per eight hour day. Further, each machining operation is critically analyzed with respect to problem areas and suggested method to improve upon them are given.
Author (TAB)

N66-21473# Rock Island Arsenal Lab., Ill. Research and Engineering Div.
FACTORS INFLUENCING CORROSION PROTECTION PROVIDED BY SOLID FILM LUBRICANT COATINGS Final Technical Report
George P. Murphy and Francis S. Meade Dec. 1965 25 p refs (RIA-65-3380; AD-627395) CFSTI: HC $1.00/MF $0.50

This investigation included the effect of (1) resin–pigment ratio, (2) coating thickness, and (3) wearing away of the film on the corrosion protection provided by solid lubricant coatings. Two series of solid film lubricants of various resin–pigment ratios were made using good and poor pigment dispersion techniques. These series of solid film lubricants were evaluated at several levels of coating thickness. Corrosion protection was evaluated by means of 20% Salt Fog cabinet while wear life was determined by the Falex Wear Test method. A combination friction–salt fog test was used in determining the effect of wearing away of the film on corrosion resistance. It was found that a solid film lubricant can be manufactured, using good pigment dispersion techniques, which will provide 1000 hours of salt fog protection. This lubricant showed no loss in wear life. It was also found that, by using a 0.0010 in. coating made up of two layers, salt fog life can be increased by at least 6 fold without sacrificing wear life. Author (TAB)

N66-21488# Laboratory for Electronics, Inc., Boston, Mass. Solid State Electronics Lab.
ELECTRO-OPTICAL MATRIX DISPLAY Interim Development Report, 18 Sep.–18 Dec. 1965
[1965] 17 p
(Contract NObsr-91199)
(IDR-480-Q5; AD-627696) CFSTI: HC $1.00/MF $0.50

Colloidal suspensions in glycerine and glycol-type solvents have been developed which have long term freedom from immobilization, and appear to simplify many aspects of module fabrication. Immobilization behavior observed is attributed in large part to spacing problems, both in non-aqueous and aqueous solvents. New substrate holders and heaters have been constructed to evaporate films over the entire substrate and chromium underlayers are currently in use to increase film adhesion. A cover glass containing internal spacers and sealing surface fabricated by etching with HF has been developed and should simplify spacing and sealing problems. Amplifiers were constructed to drive display elements in AC pulse writing mode, and necessary modification and testing is in progress. Design of the demonstration model to be delivered is in progress and consideration is being given to requirements of illumination and electronics to produce a completely self-contained unit. Author (TAB)

N66-21491# Naval Civil Engineering Lab., Port Hueneme, Calif.
ELECTRICAL PROPERTIES OF COATINGS AS RELATED TO PERFORMANCE. I: EXPERIMENTS WITH FIVE IMMERSED COATING SYSTEMS
Peter J. Hearst 21 Dec. 1965 49 p refs
(N-795; AD-627311) CFSTI: HC $2.00/MF $0.50

Five coating systems on steel panels were immersed in salt water for up to nearly two years. AC electrical properties of the coatings were determined and were compared with the performance of the coatings. There was appreciable correlation between electrical properties and performance.
Author (TAB)

N66-21693*# Sperry Farragut Co., Bristol, Tenn.
REACTION WHEEL WITH BRUSHLESS dc MOTOR DRIVE Final Report
W. M. Casaday Washington, NASA, Apr. 1966 64 p refs (Contract NAS5-9016)
(NASA-CR-388) CFSTI: HC $0.95/MF $0.75 CSCL 09A

This final report describes a program to design, develop, and manufacture four reliable, efficient, lightweight, sealed brushless dc reaction wheel systems. In these motors photo-optical detectors and transistorized switches perform the functions of a conventional commutator without physical contact between the commutator and armature. The principles of operation of a brushless dc motor are well known and are explained. Author

N66-21728*# Harris Research Labs., Inc., Washington, D. C.
THE EFFECT OF SURFACE CONTAMINATION ON CONTACT ANGLES AND SURFACE POTENTIALS Summary Report
Anthony M. Schwartz and Alfred H. Ellison 13 Jan. 1966 46 p refs
(Contract NAS3-7104)
(NASA-CR-54708) CFSTI: HC $2.00/MF $0.50 CSCL 13H

A study was conducted to determine the effect on contact angles and surface potentials of contaminants applied to clean metal substrates and to determine the effectiveness of currently used propellant tank cleaning procedures in restoring the contact angles and surface potentials to the values obtained on the clean substrates. In addition, contact angle data were obtained for mercury on six different substrates over a range of temperatures from 25° to 150° C. Author

N66-21730*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LOW TEMPERATURE MECHANICAL PROPERTIES OF HIGH STRENGTH A-286 BOLTS
J. W. Montano 9 Mar. 1966 34 p refs
(NASA-TM-X-53407) CFSTI: HC $2.00/MF $0.50 CSCL 13E

This report presents the mechanical properties of high strength A-286 alloy bolts and reduced shank bolt specimens which were tested at temperatures from ambient to −423°F (−253°C). These bolts were manufactured by the Camcar Screw Company utilizing the "Ray-Carl" cold heading process. The mechanical properties of these bolts were compared with those of other high strength A-286 alloy bolts that were manufactured by different methods. It was concluded from the low temperature tests that the high-strength A-286 alloy bolts of 7/16-inch diameter, 20 threads per inch, are satisfactory for structural application in space vehicles at temperatures from ambient to −423°F (−253°C). Author

N66-21784*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WELDING PROGRESS SUMMARY
[1965] 87 p
(NASA-TM-X-57330) CFSTI: HC $3.00/MF $0.75 CSCL 13H

Reports on welding, welding defects, and the variables which affect the welding process are presented. The topics discussed include: the time-temperature effects on aluminum welding; the variables affecting the occurrence of weld defects in aluminum alloys; a theoretical model based on nucleation and growth theory for the porosity formation in aluminum welds; transference of inert-gas welding settings and data from machine to machine and facility to facility; and the correlation between porosity and other defects and the mechanical behavior of a weld joint. N.E.N.

N66-21787# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
EXPLOSION DURING CONSTRUCTION OF A FUZE ARM AT THE CENTRALE WERKPLAATS, TECHNISCHE DIENST, UTRECHT [EXPLOSIE BIJ BEWERKING VAN EEN FUSEARM IN DE CENTRALE WERKPLAATS, TECHNISCHE DIENST TE UTRECHT]
G. Verhoef and A. Lokma 1 Dec. 1965 20 p In DUTCH
(TL/1965/22; TDCK-44191) CFSTI: HC $1.00/MF $0.50

The cause of an accidental explosion was investigated, and the results of the failure analyses are presented. It was determined that the explosion occurred during the boring of holes in the fuze arm rather than during the welding process, and was caused by the sudden ignition of hydrogen gas and air. It was assumed that the hydrogen gas developed over a three-week period, due to the acid anti-rust fluid eating into the iron fuze arm. Apparently this fluid entered through a ventilation hole during the anti-rust treatment, and the fuze arm was then resealed with a bolt. About three weeks later, when an electric tool was used to bore a ventilation hole in the arm, the hydrogen escaped under high pressure and exploded, presumably as a result of the friction heat of the bore. Computations based on the fluid analysis indicate that the hydrogen pressure could have been about 20 atm. Transl. by J.O.

N66-21794# Instituut TNO voor Verpakkingen, Delft (Netherlands).
RESEARCH INTO THE PACKAGING OF TRIOXANE TABLETS [NEBZOEK VERPAKKING VOOR TRIOXAANTABLETTEN]
H. J. Lelie 15 Dec. 1965 22 p refs In DUTCH
(IVV-509; TDCK-44367) CFSTI: HC $1.00/MF $0.50

Cellulose, aluminum, and polyethane layer materials were evaluated to determine their suitability for packaging trioxane tablets. Testing was conducted on storage life, brittleness, and packaging leaks, with the possible sublimation of the product inside the packaging considered. Brittleness, leaking, and sublimation tests proved satisfactory. All types of packaging underwent delamination of the materials, with some indications that chemical erosion by the vapor product was the cause. Storage test results were inconclusive, pending further delineation of the effects of temperature changes and dampness. Transl. by J.O.

N66-21854# Rock Island Arsenal Lab., Ill. Research and Engineering Div.
FATIGUE STRENGTH OF THREADED STEEL RODS Final Report, Sep. 1963-Dec. 1964
F. K. Blessin May 1965 30 p refs
(RIA-65-1094; AD-617095) CFSTI: HC $2.00/MF $0.50

An investigation was made to determine the fatigue strength of several types of threads suitable for use on 105 mm Howitzer Recoil Mechanism piston rods. Fatigue tests, which simulated the loading of the piston rods were conducted with 124 threaded specimens. The specimens were 1.125 and 1.250 inches diameter and had conventional UNF ground, large root radius UNJF ground, and large root radius UNJF rolled threads. Specimens of both sizes with large root radius rolled threads had an average of 34 percent greater fatigue strength than specimens with ground threads of the same profile. Specimens with large root radius ground threads had an average of 7 percent greater fatigue strength than those with conventional UNF ground threads. Considering all three types of threads, the 1.250 inch diameter specimens, with 27 percent more stress area, were only 9 percent stronger than the 1.125 inch diameter specimens. Limited tests at −65°F showed that the fatigue strength of the specimens was greater at this temperature than at temperatures from 60° to 90°F. Author (TAB

N66-21860# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON VEHICLE TECHNIQUE [LITERATUUROVERZICHT, AUTOMOBIEL-TECHNIEK]
16 Feb. 1966 28 p refs *Its* Vol. No. 2, No. V-7
CFSTI: HC $2.00/MF $0.50

Abstracts and bibliographic notes on military vehicles, trucks, cars, vehicle properties, development and testing, car parts, electrical equipment, motor technology, and technical news are included. Transl. by J.O.

N66-21978# Southwest Research Inst., San Antonio, Tex. Dept. of Aerospace Propulsion Research.
FUNDAMENTAL INVESTIGATION OF LIQUID-METAL LUBRICATED JOURNAL BEARINGS Quarterly Technical Report No. 5, 1 Aug.-31 Oct. 1965
R. A. Burton, Y. C. Hsu, and H. J. Carper 1 Nov. 1965 63 p
(Contract AT(11-1)-1228)
(SWRI-1228-8-16; RS-471) CFSTI: HC $3.00/MF $0.75

An analytical approach to continuous turbulent film described in previous reports, is exploited to provide estimates of performance of very short, full bearings operating in the turbulent regime. Similarly, the analysis is applied to tilted pads without end leakage, and shown to check with experimental measurements. Computer techniques are described whereby the analysis technique can be applied to finite

bearings, of arbitrary film thickness variation. Experimental data are reported for leading edge pressure rise under tilted pads, and for the pressure distribution under stepped pads. Further analysis is given for steady and fluctuational velocity profiles near a blockage in the bearing clearance.
Author (NSA)

N66-21981# National Lead Co. of Ohio, Cincinnati.
THE PLASMA SPRAYING OF PROTECTIVE COATINGS
D. L. Elston 29 Sep. 1965 18 p Presented at the 15th Ann. Natl. Lead Co. Anal. and Phys. Testing Symp., Highstown, N. J., 14-15 Oct. 1965
(Contract AT(30-1)-1156)
(NLCO-966; CONF-651029-2) CFSTI: HC $1.00/MF $0.50

Direct-current, arc-generated plasma equipment was developed that makes possible the melting and deposition of refractory materials of even the highest melting points. The resulting coatings have little porosity, bond well, and are ready for immediate use. The plasma-spraying system was installed for the primary purpose of developing protective coatings for the graphite crucible and other graphite components used in melting and casting uranium. The equipment and auxiliary components are described, along with the procedure used.
NSA

N66-22003# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-12 Plant.
EFFECTS OF TEMPERATURE ON MACHINING OPERATIONS
H. F. Smith, Jr. 29 Nov. 1965 15 p
(Contract W-7405-ENG-26)
(Y-DA-1014) CFSTI: HC $1.00/MF $0.50

The results on a program to determine the effects of temperature on current production equipment indicated that inadequate attention is being given to this variable by many machine tool and gage manufacturers and users. Sources of temperature errors are discussed.
NSA

N66-22020# Sandia Corp., Livermore, Calif.
CIRCUIT-BOARD PRODUCTION BY COMPUTER METHODS
L. A. James Jun. 1965 20 p
(Contract AT(29-1)-789)
(SCL-DR-65-60) CFSTI: HC $1.00/MF $0.50

Circuit-board production can be improved by the use of numerically controlled machine fabrication techniques. A coordinate digitzer is used to efficiently extract information from design layouts. The layout is reduced to the elements of a drawing: points, lines, and circles. A drilled hole is considered a point, a terminal area can be called a spot, and a conductor path in a series of straight lines. By the use of these analogies, a computer can be instructed to generate a punched tape, which is then used to direct machines in preparation of boards or templates. The technique, while not yet fully developed, promises to eliminate much of the time involved in the production of handmade masters, as well as to improve the accuracy of the finished product.
Author (NSA)

N66-22188# Institut de Soudure, Paris (France).
SURVEY OF ELEMENTARY CRACKING—PRELIMINARY QUALIFICATION SURVEY OF THE OPERATIVE METHOD OF WELDING Quarterly Report No. 6, Apr. 1-Jun. 30, 1964
[1964] 11 p Transl. into ENGLISH from French
(EURATOM-090-62-12 RDF)
(EURAEC-1098)

A preliminary interpretation of some results from studies of arc welding processes is presented. Scanning the hardness of the beads deposited by welding under flux and by the metal inert gas process (MIG) were considered. Cracking tests by welding with coated electrodes were conducted, and the thermal cycle of welding corresponding to these processes were studied. It was determined that cold welding, welding under flux, and welding with coated electrodes give comparable hardness, while the MIG process appears to yield greater hardness. When welding under flux however, it was observed that preheating leads to maximal hardness. Studies of the thermal cycle of this process did not yield an adequate explanation for this phenomena. Graphs are provided which correlate the data derived from this research.
H.S.W.

N66-22189# Roentgen Technische Dienst N. V., Rotterdam (Netherlands).
NON DESTRUCTIVE WELDING RESEARCH Quarterly Report No. 10, Oct. 1-Dec. 31, 1963
15 Jul. 1964 18 p Transl. into ENGLISH from Dutch
(EURATOM-045-61-5 RDH)
(EURAEC-1151)

The speed of different film types was established for the radiation energy involved. The image quality obtained by combinations of different tantalum-, lead- and saltscreens was compared. The best image quality was achieved with a tantalum screen of 1.5 mm in front and no screen at the back. Multiple film technique was tried with two and three films exposed simultaneously. It was found that the image quality of the film added and the definition of the combined films are always poorer. The contrast, however, is increased so that for a given exposure time, some gain in image quality may be expected. The influence of the density on the image quality was also studied. A tentative conclusion is that for the film type studied, an optimum lies roughly between two and four. Comparing the image quality for exposures from 20–120 mm, it appeared that this remains practically the same. The wire visibility for thicknesses from 20–300 mm varies from 3% to 4%.
Author

N66-22346*# Solar, San Diego, Calif.
ESTABLISHMENT OF AN OPTIMUM HEAT TREATMENT FOR USE IN 718 ALLOY BELLOWS AND GIMBAL STRUCTURES Semiannual Report, 1 Aug. 1965-28 Feb. 1966
Paul J. Valdez Mar. 1966 23 p refs
(Contract NAS8-11282)
(NASA-CR-71997; NASA-R-ME-IV-S-4; RDR-1460) CFSTI: HC $1.00/MF $0.50 CSCL 13H

The hot cracking tendency of fusion welds in thin gage (0.040 in.) as well as in thicker sections (up to 0.300 in.) of the Inconel 718 alloy was studied by means of the Varestraint dynamic loading apparatus. This study was conducted to investigate the mechanisms involved in the microcracking of the 718 alloy as part of a larger study to learn the effects of thermal treatments on the 718 alloy and the relation of subsequent fabrication processes to the thermal treatments. Four alloy heats were tested, and its was found that the annealing temperatures appear to be the most influential factor in promoting cracking sensitivity of the 718 alloy. There was no particular pattern in the sensitivity to hot cracking from one heat to another in relation to a particular heat treatment. However, all heats became significantly more sensitive to hot cracking as the annealing temperature is increased above 1750°F.
E.A.O.

N66-22347*# Pratt and Whitney Aircraft, East Hartford, Conn.
DEVELOPMENT OF COMPRESSOR END SEALS STATOR INTERSTAGE SEALS, AND STATOR PIVOT SEALS IN AIR BREATHING PROPULSION SYSTEMS Semiannual Report No. 1, 29 Jun.–31 Dec. 1965
R. M. Hawkins and C. A. Knapp 20 Jan. 1966 213 p refs
(Contract NAS3-7605)
(NASA-CR-54625; PWA-2752) CFSTI: HC $6.00/MF $1.25 CSCL 11A

Feasibility analyses were conducted on different concepts of compressor end seals, stator interchange seals, and stator pivot seals for multistage axial flow compressors used in advanced air breathing propulsion systems. Major emphasis was placed on the analysis of primary seal faces. The sealing studies were initiated to achieve a means of increasing compressor efficiency by reducing the air leakage rate while not incurring undue penalties in reliability and weight. The basic leakage rate, film thickness for minimum power loss, thermal distortion, tracking dynamics, and primary and secondary back-up seal configurations are discussed for compressor end seals and stator interchange seals. It was determined that a combination of hydrostatic and hydrodynamic types would be preferable for the primary seal. For the stator pivot seals, two types were selected after preliminary screening: a spherical seat face seal, and a single bellows face seal. Film thickness studies, a hybrid lubrication problem solution, and computer programs for hydrostatic pressure and spiral groove seal pressure and flow are appended. E.A.O.

N66-22370*# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
LUNAR TV: QUALITY PROGRAM PLAN
[14 Jun. 1965] 120 p
(Contract NAS9-3548)
(NASA-CR-65316) CFSTI: HC $4.00/MF $0.75 CSCL 14D

The plan to insure adequate quality control in the development of the Lunar TV Camera is outlined. Procedures are established for project management, design and development control, material control, inspection, training and certification of personnel, data reporting, and the preservation, packing, handling, storage and shipping of components. H.S.W.

N66-22371*# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
LUNAR TV: RELIABILITY EVALUATION PLAN
G. W. Kraeger 15 Apr. 1965 43 p
(Contract NAS9-3548)
(NASA-CR-65315) CFSTI: HC $2.00/MF $0.50 CSCL 14D

The reliability plan for the Lunar TV Camera project is presented. The formalized test requirements for deliverable hardware are summarized, from the part supplier's testing through and including camera development, qualification, and acceptance testing of the flight qualified model. The major components of the camera are listed and the responsibilities for the testing of these components are outlined. H.S.W.

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N66-21141# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
DEVELOPMENT OF A LASER AMPLIFIER AND ITS APPLICATION IN PLASMA DIAGNOSTICS [ENTWICKLUNG EINES LASER-VERSTARKERS UND SEINE ANWENDUNG IN DER PLASMA-DIAGNOSTIK]
H. Zietemann Jun. 1965 35 p refs In GERMAN; ENGLISH summary
(IPP-1/42) CFSTI: HC $2.00/MF $0.50

In order to measure the electron temperature and the electron density of a 26 K Joule θ-pinch by means of light scattering, a high power laser has been assembled by combining an oscillator laser and an amplifier laser. The amplification of the oscillator impulse by the ruby of the amplifier laser was calculated and measured. The amplification is expressed as function of the temperature of the amplifier ruby. Maximum impulse power: 25 MW. During the first maximum compression the maximum electron temperature was 50 eV, and at the moment of the maximum B-field the maximum temperature was 85 eV. The corresponding electron densities were measured as max. 1.3×10^{17} particles/cm^3 and 1.6×10^{17} particles/cm^3 respectively. The spatial distribution of electron temperature and electron density in the plasma is also stated. Author

N66-21376# CBS Labs., Stamford, Conn.
OPTICAL SPOT SIZE STUDY FOR DATA EXTRACTION FROM A TRANSPARENCY Final Report, Feb.–Jul. 1965
L. L. Izzo and H. A. Cubberly Wright-Patterson AFB, Ohio. AMRL, Sep. 1965 80 p
(Contract AF 33(615)-2355)
(AMRL-TR-65-175; AD-628588) CFSTI: HC $3.00/MF $0.75

A breadboard model scanner using coherent light to generate a small optical spot for data extraction from a transparency was constructed. Using the technique developed, a capability of distinguishing 256 lp/mm and 30 shades of gray from light to dark was demonstrated. The system consists of a laser light source, a beam expander, a beam normalizer, a rotating optical scanning system to cover a 2-inch wide transparency, a transparency holder, a light collector and a photomultiplier assembly including video amplifier and high voltage power supply. These system components are basically 'off-the-shelf' items. Author (TAB

N66-21405# Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
TECHNIQUES FOR SUPER-MODE OSCILLATION Interim Engineering Report, 1 Sep.–30 Nov. 1965
Russell Targ, B. J. Mc Murtry, and S. E. Harris [1965] 53 p refs
(Contract AF 33(615)-2884)
(IER-2; AD-624845) CFSTI: HC $3.00/MF $0.50

The report describes an experimental and theoretical program to determine the fundamental properties of the FM and super-mode lasers. These two techniques make it possible to obtain at a single frequency the full power of a high-power multi-mode laser without suffering the loss in power inherent in conventional approaches involving the suppression of modes. The work of this program is divided broadly between two main activities. The first is to obtain a more complete understanding of the physics governing the operation of the FM and super-mode lasers. The second is concerned with improving the techniques for coupling the modes of the FM laser and finding more efficient means for full power super-mode conversion of the FM signal to a monochromatic output. Progress to data is summarized. TAB

N66-21435*# Radio Corp. of America, Princeton, N. J. Microwave and Power Devices Operations Dept.
DESIGN AND FABRICATION OF A LASER MODULATOR Final Report, Jul. 27–Oct. 27, 1965
11 Nov. 1965 28 p refs
(Contract NAS5-9620)
(NASA-CR-71516) CFSTI: HC $2.00/MF $0.50 CSCL 16E

The development of a laser modulator capable of producing 40% depth of modulation for an applied voltage of 400 volts rms over a bandwidth from dc to 6 Mc/sec is presented. The program incorporated a parallel effort on both gallium arsenide and gallium phosphide electro-optic crystals. In addition, some work was done on potassium tentalate niobate. An attached paper gives a summary description of GaAs electro-optic modulators having a linear aperture of 3 mm×3 mm and an angular aperture greater than 12 degrees.
C.T.C.

N66-21496# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE LIMIT CROSS SECTION OF THE RADIATION BEAM FROM AN OPTICAL QUANTUM GENERATOR
N. G. Basov, E. N. Belenov, and V. S. Letokhov 5 Nov. 1965 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 161, no. 4, 1965 p 799–801
(FTD-TT-65-1003/1+4; AD-627995) CFSTI: HC $1.00/MF $0.50

This article examines the limitations on the cross section of the radiation beam from optical quantum generators. In optical quantum generators of a steady state, when there are extremely high transverse resonator dimensions, a cross section limitation of the radiation beam is theoretically possible because of a retardation of reciprocal action in the remote ranges of the generator, or a detuning of the eigenfrequencies of discrete resonator sections. In optical pulse generators (generators with a Q-modulation), the cross section limitation arises because the process of radiation generation by the material occurs during the stabilization sequence period of the resonator's oscillation modes. Author (TAB)

N66-21898*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYDROGEN MASER FREQUENCY COMPARISON WITH A CESIUM BEAM STANDARD
E. H. Johnson and T. E. Mc Gunigal Washington, NASA, Apr. 1966 15 p refs
(NASA-TN-D-3292) CFSTI: HC $0.20/MF $0.50 CSCL 20E

A direct measurement of the hyperfine energy-level splitting (splitting the energy band into sublevels) of the hydrogen atom has been made by comparing the frequency of an atomic hydrogen maser and a cesium-beam frequency standard. The two standards were compared for the period of one day. The measured value of the F=1, M_f=0→F=0, M_f=0 hyperfine transition corrected to zero field is 1420405751.781 ±0.016 (A-1 Time Scale). Author

N66-21774# Hughes Aircraft Co., Fullerton, Calif.
LASER COMMUNICATIONS STUDY Final Report, 1 Jul. 1964–31 Aug. 1965
T. M. Straus, J. E. Kiefer, and F. Chethik Jan. 1966 88 p refs
(Contract DA-28-043-AMC-00195(E))
(FR-66-14-37; AD-477691)

The design of a laser communications system was predicated upon obtaining a tool with which the deleterious effects of the atmosphere on a FM signal could be measured. The system incorporates the elements of a coherent communications system with sufficient bandwidth to handle a 12 voice channel binary multiplex. Modulation of the light is accomplished in the UHF region. This is a single-ended system (i.e. a mirror is used at one end) utilizing a single laser to provide LD and signal beam power. The system design was implemented during the development phase. A two-element electro-optic modulator enclosed in a UHF cavity to obtain the desired frequency translation is described. In an additional operational mode the carrier is not suppressed and the local oscillator is transmitted with the signal. Atmospheric path study tests showed both modes were at times greatly degraded by atmospheric turbulence. This is primarily attributed to thermal gradients in the atmosphere. The heterodyne signal degraded more than the self-mix (carrier plus sideband) mode.
Author (TAB)

N66-22191*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRACKING OF THE BEACON-EXPLORER SATELLITES WITH LASER BEAMS
Henry H. Plotkin [1965] 4 p refs Submitted for Publication
(NASA-TM-X-56631) CFSTI: HC $1.00/MF $0.50 CSCL 20E

The value of using lasers for accurate tracking of orbiting optical reflectors is assessed. Results of optical tracking experiments with the Beacon Explorer satellites indicate that precise measurements of satellite positions may be determined. Present optical tracking methods require photography by reflected sunlight at a time when the sky is dark enough to permit simultaneous photography of the stars, however it is observed that studies are being conducted to permit laser range determinations during daylight and when the satellite is in the shadow of the earth.
H.S.W.

N66-22338* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT OF A LASER DOPPLER FLOWMETER FOR GAS VELOCITY MEASUREMENT
W. Foreman (Brown Eng. Co.) and Robert M. Huffaker *In its* Aero-Astrodyn. Res. Rev. No. 3 15 Oct. 1965 p 66–71 refs (See N66-22329 11-34) CFSTI: HC $4.00/MF $1.00

The large magnitudes of the Doppler shifts obtainable, using a cw gas laser, suggest that local velocity vectors can be measured by using the visible light from the laser. Optical heterodyning of the laser light with a portion of the incident laser beam will produce a beat signal at the frequency of the Doppler shift due to the motion of the gas. Measurement of the beat signal frequency, together with the geometry of the optical system, determines the flow velocity of the gas. A probeless velocity measuring technique has been developed based on this principle. This technique has been checked in a wind tunnel at speeds up to 500 ft/sec (150 m/sec). This technique also gives a distribution of velocities due to the turbulence level of the gas flow. This technique is also applicable for the measurement of velocity of any moving surface. Some applications will be the measurement of panel flutter and for a calibration of dynamic pressure transducers. Author

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N66-21108# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

SOLIDIFICATION OF IRON BASE ALLOYS AT LARGE DEGREES OF UNDERCOOLING Interim Report, Oct. 1, 1964–Sep. 30, 1965

T. Kattamis and M. C. Flemings [1965] 120 p refs (Contract DA-19-020-AMC-023(X))

(AMRA-CR-64-0712; AD-626225) CFSTI: HC $4.00/MF $0.75

A study was made of structure and solute redistribution in bulk samples of iron and nickel base alloys undercooled up to 300° C. Alloys undercooled were iron–25 percent nickel iron–25 percent nickel–0.3 percent sulphur, iron–25 percent nickel–1.4 percent carbon, nickel–25 percent copper, and AISI 4330 low alloy steel. Detailed morphology studies were conducted on nickel–25 percent copper alloy. Results were nearly identical to those obtained earlier in iron–25 percent nickel alloy. Cursory examination of other alloys indicates results obtained for the iron–nickel and nickel–copper alloy can be expected to apply to substantial degree to these systems. The dendrite element spacing, for cylindrical and spherical morphologies, decreases with increasing undercooling, increasing rate of heat extraction from the bulk sample, and decreasing distance from a chill surface. The transition of cylindrical to spherical morphology depends only on initial undercooling. The distribution of solute was studied metallographically and by electron microanalysis. Nickel concentration profiles and isoconcentration curves were established and segregation ratios measured in both internally chilled and non-internally chilled iron–25 percent nickel specimens undercooled various amounts. Author (TAB)

N66-21165# Atomic Weapons Research Establishment, Aldermaston (England).

THE PERMEATION AND DIFFUSION OF HYDROGEN ISOTOPES THROUGH STAINLESS STEELS. PART 2: EN58B LOW CARBON STEEL

P. M. S. Jones, R. Gibson, and J. A. Evans Nov. 1965 25 p refs (AWRE-O-90/65) HMSO: 3s

An investigation was made of the diffusion and permeability of hydrogen and deuterium through low carbon, unstabilized, austenitic type EN58B steel. Brief discussions are given of the techniques, the pressure-time dependence, membrane activation, pressure dependence of permeation rate and lag time, membrane deactivation, pressure dependence of permeation rate, temperature dependence of permeation and diffusion coefficients, and the isotope effect. It was found that $P_H = 0.463 \exp(16000 \pm 200/RT)$ std ml cm^{-2} mm s^{-1} $atm^{-0.5}$ and that $D_H = (2.1 \pm 0.9)10^{-3} \exp(1000 \pm 1200/RT)$ cm^2 s^{-1}. There was no significant isotope effect on the diffusion coefficient but hydrogen permeates 1.4 times more rapidly than deuterium. C.T.C.

N66-21188# Aeronautical Research Labs., Melbourne (Australia).

THE DEVELOPMENT OF AN ALUMINIUM-MAGNESIUM CASTING ALLOY CONTAINING SMALL ADDITIONS OF SILVER

I. J. Polmear Jul. 1965 32 p refs (ARL/MET-27) CFSTI: HC $2.00/MF $0.50

The addition of silver to the casting alloy B.S. 1490: LM5 renders it amenable to age hardening and chill cast ingots and test bars of LM5+0.5% silver have shown average tensile strengths of 18.5 and 19.3 t.s.i. respectively. These values are close to the 20 t.s.i. specified for B.S. 1490: LM10 and are achieved without incurring the casting problems associated with this higher magnesium material. The silver containing alloy shows satisfactory ductility and has a microstructure which would make it resistant to the problem of grain boundary embrittlement on long exposure to ambient temperatures, even in a tropical location. Tests indicate that the alloy can be expected to show a corrosion resistance comparable with LM10. Author

N66-21260# Boeing Scientific Research Labs., Seattle, Wash.

SOLID STATE PHYSICS LABORATORY REVIEW, JULY-DECEMBER, 1965

31 Dec. 1965 30 p refs

A significant fraction of the experimental work was directed toward problems of metal fatigue failure in humid, corrosive environments. This included cracking, composition, heat treatment, and phase transformations. Another area of investigation concerned the interaction of elastic waves (coherent phonons) and thermal conductivity (noncoherent phonons and electrons). Antiferromagnetic transitions and phonon dislocation scattering were also discussed. The construction of a low temperature tensile calorimeter and the applications of an inert thermometer were reported. Other areas of study include thermal desorption, optical and electron paramagnetic resonance spectroscopy, lattice defect energies, and X-ray absorption and electron spin effects in X-ray absorption fine structure. N.E.N.

N66-21268# Aktiebolaget Atomenergi, Stockholm (Sweden).

AN ELECTRON MICROSCOPE STUDY OF THE THERMAL NEUTRON INDUCED LOSS IN HIGH TEMPERATURE TENSILE DUCTILITY OF NB STABILIZED AUSTENITIC STEELS

R. B. Roy Apr. 1965 20 p refs (AE-186) CFSTI: HC $1.00/MF $0.50

The irradiated and corresponding unirradiated control tensile specimens of a 20% Cr, 25% Ni, Nb stabilized steel tested at 650°C, 750°C and 800°C have been examined by transmission electron microscopy. The results indicate that the transmission electron microscopy. The results indicate that the irradiation induced embrittlement of the tensile specimens at elevated temperatures is preceded by the formation of fine precipitates within the grains. These precipitates may restrict the deformation within the grains such that the stresses are concentrated at the grain boundaries thereby leading to premature failure. It is suggested that the main effect of the irradiation is to promote conditions necessary for the formation of these precipitates, namely, supersaturation and fresh nucleation sites within the matrix through the energetic emission of He and Li atoms from boron as an impurity. Author

N66-21276# Atomic Energy of Canada, Ltd., Chalk River, (Ontario).

AN EQUATION FOR CREEP OF COLD WORKED ZIRCALOY PRESSURE TUBE MATERIAL

E. F. Ibrahim Dec. 1965 23 p refs
(AECL-2528) CFSTI: HC $1.00/MF $0.50

The following equation was derived for creep of cold worked Zircaloy 2 pressure tube material in the temperature range from 300° to 450°C: $\epsilon = 2.768 \times 10^{-5} e^{(1.5T \times 10^{-2} + 9.633\sigma \times 10^{-5})t(1.655T \times 10^{-3} - 0.297)}$, where ϵ is equal to strain, T is equal to temperature, σ is equal to stress, and t is equal to time. D.T.

N66-21320# Army Materials Research Agency, Watertown, Mass. Materials Engineering Div.

TEXTURES IN TITANIUM SHEET AND ITS EFFECTS ON PLASTIC FLOW PROPERTIES

Frank R. Larson Oct. 1965 29 p refs
(AMRA-TR-65-24; AD-626410) CFSTI: HC $2.00/MF $0.50

The anisotropic behavior of polycrystalline material depends upon the variation of properties of single crystals as a function of orientation and the perfection or intensity of the texture. The understanding of such behavior patterns must be related to a knowledge of textural variations and single crystal properties. Hexagonal close-packed metals usually exhibit fairly large anisotropy in the single crystal form and the textures that develop during processing are more intense for this structure. The anisotropic behavior patterns of polycrystalline hexagonal materials are quite large. Textures commonly found in titanium and its alloys can be classified according to processing procedures of the alloy and the mill products. Sheet textures may be described as rotated (0001) textures in which the peak is tilted toward the transverse direction between 30 and 60 degrees. A study of the microstructure and alloy compositional effects shows that beta rolling increases the transverse tilt of the basal poles. The effect of increasing additions of beta stabilizing elements is similar to that of beta rolling. A variety of alloys in sheet form have been tested and the anisotropy of mechanical properties measured. It was discovered that the elastic and plastic flow properties are intimately related. Both of these properties, plus yield strength, can be understood from a knowledge of single crystal properties, assuming that the sheet has a very strong texture. Author (TAB)

N66-21324# Naval Research Lab., Washington, D. C.

PROTECTIVE COATINGS FOR MAGNESIUM ALLOYS. PART 2: RESISTANCE OF FLAME-FUSED TEFLON-COATED MAGNESIUM AND ALUMINUM ALLOYS TO CORROSION BY 3% SODIUM CHLORIDE SOLUTIONS

D. L. Venezky, A. G. Sands, and E. B. Simmons, Jr. 15 Dec. 1965 35 p refs
(NRL-6353; AD-626213) CFSTI: HC $2.00/MF $0.50

Teflon one-coat green enamel, which has been applied in thin films, 0.0002 to 0.0004 in. thick, and which has been properly flame fused, will not be wet by the 3% sodium chloride solution during the test period; specimens having such Teflon coatings exhibit enhanced corrosion resistance. Three methods were evaluated as accelerated corrosion tests: an immersion test, a salt droplet test, and a spherical-joint contact test which could be modified to measure the relative resistance of the coated specimens. Magnesium alloy $AZ_{31}B$-H_{24}, chrome pickled, was most resistant to corrosion when coated with flamefused Teflon one-coat green enamel; magnesium alloy specimens treated otherwise exhibited enhanced corrosion rates. Aluminum alloy 6061-T6, Teflon coated and flame fused, exhibited the greatest corrosion resistance when compared with the other aluminum alloys tested. No correlation was found between the various aluminum alloy tempers studied and the corrosion rate. In general, the corrosion tests indicate that the flame-fused Teflon coating afforded some protection against corrosion as compared to the uncoated specimens. TAB

N66-21398# Martin Co., Orlando, Fla.

STACKING FAULTS Final Report

Ralph P. I. Adler Dec. 1965 16 p refs
(Contract Nonr-3706(00))
(OR-6891; AD-625834)

All original experimental, analytical, and theoretical work performed on stacking faults in crystalline materials is summarized. Highlights of this project are listed and references are made to publications in the open literature, abstracts, discussions, and invited presentation where details are elaborated. Experimental work was primarily performed using X-ray diffraction and electron microscopy techniques. Materials investigated included 70:30 brass, Cu-6.6 atomic percent Si, niobium, tantalum, cerium, alpha-uranium, carbon, and boron. Theoretical and analytical studies were also performed to identify the contribution of faults, twins and thin platelets to diffraction phenomena and to standardize the terminology in indexing the hexagonal system. Author (TAB)

N66-21478# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SEVERAL TERNARY COMPOUNDS OF THE TYPE- $A^{I}B_{2}^{IV}C_{3}^{V}$

V. I. Sokolova and Ye. V. Tsvetkova 5 Nov. 1965 11 p refs
Transl. into ENGLISH from "Issledovaniya po Poluprovodnikam; Novyye Poluprovodnikovyye Materialy" MOLSSR, Gos. Izd-Vo Kartya Moldovenyaske, 1964 p 168-172
(FTD-TT-65-765/1+2+4; AD-627855) CFSTI: HC $1.00/MF $0.50

Results are reported of phase studies of semiconducting systems comprised of: one part copper, silver, or gold; to two parts silicon, germanium, tin, or lead; to three parts phosphorus, arsenic, antimony, or bismuth. TAB

N66-21493# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.

DISLOCATION DISTRIBUTIONS IN FATIGUED SINGLE CRYSTALS OF 3.25% SILICON-IRON

Kent Randall Carson (M.S. Thesis) 3 Jan. 1966 119 p refs
(Contract Nonr-1228(32))
(TR-2; AD-627811) CFSTI: HC $4.00/MF $0.75

Fatigue tests were performed on single crystals of 3.25% silicon-iron oriented for single slip. The behavior of dislocations was studied in the early stages of the fatigue process as a function of temperature, number of cycles, and state of stress. A particular emphasis was placed upon observing tangle formation and growth. Part of the tests were performed by cycling about a zero mean stress in 4-point bending. Crystals were fatigued in this manner for various numbers of cycles at both 298°K and 495°K. The dislocation distributions were investigated by the etch pit technique and electron transmission microscopy. The remainder of the tests were performed in alternating tension. As before, crystals were fatigued for various numbers of cycles at both 298°K and 425°K. In this case, the dislocation distributions were investigated solely by electron transmission microscopy. TAB

N66-21504# General Electric Co., Schenectady, N. Y. Research and Development Center.
AN ATOMIC VIEW OF SURFACE SELF-DIFFUSION: TUNGSTEN ON TUNGSTEN
Gert Ehrlich and F. G. Hudda Oct. 1965 25 p refs *Its* Rept.-65-C-038
(Contract AF 49(638)-1362)
(AFOSR-65-2883; AD-627837) CFSTI: HC $1.00/MF $0.50

Surface diffusion of tungsten adatoms on several smooth, low index planes of the tungsten lattice has for the first time been followed by direct observation of individual atoms in the ion microscope. Contrary to expectation, the mobility at room temperature is found to increase in the order (211)>(321)~(110)>(310)~(111). Migrating atoms are reflected at the boundaries of the (110), (211), and (321) planes; on the latter two, motion along atomic rows is favored over diffusion across lattice steps. From quantitative determinations of the rate of change of the mean square displacement, diffusion coefficients were obtained. Differences in diffusion on the (211) and (321)—planes of very similar structure—suggest a weakening of interatomic forces at lattice edges. Author (TAB)

N66-21593# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).
PROGRAMME-FATIGUE TEST ON ALUMINUM ALLOY LUG SPECIMENS WITH SLOTTED HOLES AND EXPANDED HOLES
J. Schijve and F. A. Jacobs Nov. 1964 41 p refs Sponsored by Neth. Aircraft Develop. Board
(NLR-TN-M.2139; ICAF-324) CFSTI: HC $2.00/MF $0.50

Constant-amplitude tests and programme tests were carried out on 2024-T3 lug specimens with standard holes, slotted holes and expanded holes. The results given information on (1) programme loading versus constant-amplitude loading, (2) cumulative damage and (3) the improvement of the fatigue endurance obtained by the application of slotted and of expanded holes. Author

N66-21747# Army Materials Research Agency, Watertown, Mass. Materials Engineering Div.
NOTCH STRENGTH OF HEAT-TREATED 4340 STEEL AS AFFECTED BY SUBSEQUENT COLD DRAWING AND AGING
Eugene Di Cesare Nov. 1965 19 p refs
(AMRA-TR-65-28; AD-627575) CFSTI: HC $1.00/MF $0.50

The effects of cold drawing and of cold drawing and aging on the notch tensile strength of quenched and tempered 4340 rod was investigated. The rods were heat treated, reduced up to 40 percent by cold drawing, and aged at room temperature or at 400°F. Drawing was done at speeds of 10 to 40 feet per minute with a back-pull of 0 to 16,650 pounds. The notch tensile strength of the cold-drawn rods increased with increasing yield strength up to approximately 211,000 psi. This was followed by a decrease in the notch strength. The magnitude of the aging effect on the notch tensile strength was influenced by the tempering temperature and the drawing conditions. Author (TAB)

N66-21764# Army Materials Research Agency, Watertown, Mass. Materials Engineering Div.
INFLUENCE OF TEST TEMPERATURE AND SOLUTE ADDITIONS ON THE PLASTIC FLOW AND STRAIN HARDENING OF ALPHA IRON
John Nunes Sep. 1965 69 p refs
(AMRA-TR-65-23; AD-627382) CFSTI: HC $3.00/MF $0.75

The effects of such solute alloy additions as Al, Co, Cr, Mn, Mo, Ni, Si, and V on the plastic flow and strain-hardening properties of quasi-iron binary alloys were studied over a range of testing temperatures from +200° to −196°C. A pronounced inversion of the strength of alpha iron was noted for most of the alloys studied at the lower test temperatures and higher compositions. The principal exception to this behavior is noted for the Fe-Co and Fe-Cr alloys. Strength increases as a function of composition as seen at room temperature could be reasonably approximated by a straight line relationship. However, at the lower test temperatures this linear behavior was not observed. Except for Co, Cr, and V, which show no effect, the flow stress-temperature dependence of alpha iron alloys is shown to be strongly influenced by the amount and type of solute present. Finally, the strain-hardening behavior of iron, which is characterized by a marked transition of the strain-hardening exponent n between −40° and −80°C, is shown to be strongly influenced by the added solute, with Ni giving the greatest and Co, Cr, and V giving the least effect in this transition region. A possible hypothesis is offered to explain this behavior in terms of a basic change in the deformation behavior of iron, which is characterized by a decreased tendency for cell formation. Author (TAB)

N66-21786# Climax Molybdenum Co. of Michigan, Ann Arbor. Research Lab.
DEVELOPMENT AND EVALUATION OF TUNGSTEN-BASE ALLOYS Final Report, 10 Jan. 1964-10 Mar. 1965
M. Semchyshen, Robert Q. Barr, and Eric Kalns 10 Aug. 1965 101 p refs
(Contract NOw-64-0057-c)
(AD-468299)

The investigation is concerned with the development of tungsten-base alloys having high strengths at elevated temperatures. The major portion of the alloys are ternaries containing carbon and up to nominally 0.5% Zr, 1% Hf or 2% Cb as the alloy additions; however, several quarternary alloys are included which contain carbon and the same alloying elements in various combinations. In addition, boron was substituted for carbon in three of the heats. All of the alloys were consolidated by vacuum arc melting. Primary working of the as-cast ingots was achieved by extrusion; the tungsten-base alloy blanks were encapsulated in molybdenum prior to extrusion. Additional working of the extruded materials was attempted by swaging. Even though the facilities utilized for swaging had temperatures available for heating of the work up to 3500°F, the working temperatures were too low for successful swaging of the extruded billets, and, as a result, only two alloys yielded reasonable stock after swaging. Strength properties and recrystallization temperatures are reported for the alloys after extrusion and after swaging. It is shown that both strength and recrystallization temperature are dependent of the carbon as well as the metallic alloy content. Author (TAB)

N66-21790# Polish Academy of Sciences, Warsaw.
EFFECT OF CRYSTAL STRUCTURE OF URANIUM ON THE GROWTH OF INTERMETALLIC PHASE UCu_5 [O WPLYWIE STRUKTURY KRYSTALICZNEJ NA KINETYKE WZROSTU FAZY MIEDZYMETALICZNEJ UCu_5]
1965 21 p refs In RUSSIAN; ENGLISH summary
(INR-648/XIV/PS) CFSTI: HC $1.00/MF $0.50

Diffusion layer growth in the interdiffusion in the copper-uranium system has been investigated in detail over the temperature range 570° to 910°C. The values of the activation

energies and coefficients k_0 has been determined. It has been found that the velocity of the diffusion layer growth changes abruptly near temperatures of allotropic points of uranium. The attempt of the explanation of that effect has been made. Author

N66-21814*# Aluminum Co. of America, New Kensington, Pa. Research Labs.
NEW WELDABLE HIGH STRENGTH ALUMINUM ALLOYS FOR CRYOGENIC SERVICE
H. Y. Hunsicker and J. H. Hess (NASA. Marshall Space Flight Center) [1966] 32 p refs
(Contract NAS8-5452)
(NASA-CR-71534) CFSTI: HC $2.00/MF $0.50 CSCL 11F

Two aluminum alloys were developed as high strength candidates for cryogenic structure and tankage applications with particular reference to the requirements of liquid propellant space boosters. Designated X2021 (Al-Cu type) and X7007 (Al-Zn-Mg type), these alloys are suitable for fabrication of plate and other wrought products, and will provde strengths 10% to 15% higher than present commercial weldable aluminum alloys. The alloys have good weldability, and high weld properties can be attained. In resistance to corrosion and stress-corrosion cracking, the alloys compare favorably with other high strength aluminum alloys now used for cryogenic service. Tables give such data as nominal compositions and tentative limits, mechanical properties comparisons with commercial alloys, and the effects of composition variations on the mechanical properties. Various graphs are included and show such data as the effect of Zn and Mg contents on the room temperature yield strength, and the effect of variations in elevated temperature aging on room temperature yield strength and toughness. C.T.C.

N66-21899# Springfield Armory, Mass.
INFLUENCE OF CRYSTALLOGRAPHIC AND METALLOGRAPHIC STRUCTURES ON DYNAMIC BEHAVIOR OF MATERIALS
John F. Panda and Earl H. Abbe 30 Nov. 1965 41 p
(SA-TR18-1204; AD-628039) CFSTI: HC $2.00/MF $0.50

An investigation was conducted to determine the ratio of dynamic to static yield strengths of four metal alloys having different crystallographic and metallographic structures. Thick-wall cylindrical tube specimens were hydrostatically loaded at low and high rates of strain to obtain circumferential yielding. The ratios on the inside and on the outside diameters of the specimens for the four materials investigated were as follows: stainless steel (FCC), 1.03 and 1.005; 4340 steel (BCC), 1.06 and 1.09; alpha titanium (HCP), 1.12 and 1.09; beta titanium (BCC), 1.26 and 1.29. Test procedure is given and results are discussed.
Author (TAB)

N66-21929# Ghent Univ. (Belgium). Metallurgy Lab.
THE STAINLESS STEEL PLATING OF VERY THICK STEELS Quarterly Report No. 4, 1 Apr.-30 Jun. 1965
[1965] 43 p Transl. into ENGLISH from FRENCH Prepared Jointly with N. V. Neratoom and the Soudmetal Co.
(Contract EURATOM-008-63-12 TEEB)
(EURAEC-1481) CFSTI: HC $2.00/MF $0.50

The composition and microstructures of the transition zone between the 18/10 stainless steel plating and the 1.2 MD07 A or Soudotenax 56 low alloy steel base were investigated. Variations in the Cr and Ni contents in the transition zone were attributed to structural irregularities. Metallography revealed intergranular precipitates of unknown composition in the bonding area and a bainite structure in the heat-affected zone of the base metal. NSA

N66-21931# Harvard Univ., Cambridge, Mass. Gordon McKay Lab. of Applied Science.
INTERACTION OF SOLID METAL AND LIQUID ALLOYS Final Report
Bruce Chalmers Sep. 1965 16 p refs
(Contract AT(30-1)-1956)
(TID-22271) CFSTI: HC $1.00/MF $0.50

Developments in the understanding of solidification are discussed. Studies were made primarily on: atomic processes that take place at the interface between a crystalline solid and liquid; and influence of crystallography, heat flow, and diffusion on the morphology of the growing crystals. NSA

N66-21935# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.
METALLURGICAL STUDIES OF ZIRCONIUM AND THORIUM AND OF THE ALLOYING BEHAVIOR OF RARE EARTH-TRANSITION METAL SYSTEMS Final Report
W. R. Clough 1 Nov. 1965 99 p refs
(Contract AT(30-1)-2159)
(NYO-2159-1) CFSTI: HC $3.00/MF $0.75

The effects of rare earth elements on the allotropic transformation of zirconium was studied in terms of its thermodynamic and electronic nature. In addition to the partial phase diagrams, the complete zirconium–yttrium equilibrium diagram was experimentally determined. The recrystallization kinetics of Zr-rich Zr-rare earth alloys was determined and explained. Heat of solution and heat of formation calorimetry experiments were done with the same materials, and thermodynamic explanations of observed behavior were developed. The effect of rare earth solutes on the liquid surface tension of zirconium and thorium solvents were measured by the drop method. Thorium-rare earth allotropic phase boundaries were experimentally determined under equilibrium conditions, and the effect of valence on Q_b was determined for Zr and Th solvents. Amplitude dependent internal friction measurements were performed on dilute solid solutions of Zr-rare earth binary alloys, and interactions between solute atoms and dislocations were studied. Work-hardening and fracture behavior of Zr and Zr-rare earth alloys were studied by tensile tests, optical metallography, and electron microscope means. Author (NSA)

N66-21936# Tokyo Univ. (Japan). Inst. for Solid State Physics.
LOW TEMPERATURE RESISTIVITY OF YTTRIUM-BASED ALLOYS CONTAINING SMALL AMOUNTS OF RARE EARTH METALS
Tadashi Sugawara Sep. 1965 33 p refs *Its* Ser. A, No. 171 (NP-15592)

The resistivity of the dilute alloys of rare earth metals with yttrium was measured at low temperatures. The result is in qualitative agreement with the recent theories due to Kondo and others on the s-d or s-f scattering. The effective s-f exchange integrals for various rare-earth solutes were derived from the analysis of the resistivity data and compared with the reported values in other matrices. The integral for Ce is negative, leading to a resistance minimum, while those for heavier rare earths are positive. The sign of the integral is

discussed in terms of the mixing of conduction electrons with localized 4f electrons. The increase of the residual resistivity due to added rare earths depends upon the number of 4f electrons of the solute in a complicated way and is anomalously large for lighter rare earths such as La, Ce, and Pr.
Author (NSA)

N66-21939# Atomic Energy Commission Research Establishment, Riso (Denmark). Metallurgy Dept.
METALLURGY DEPARTMENT ANNUAL PROGRESS REPORT, PERIOD ENDING MARCH 31, 1965
Jul. 1965 53 p refs
(RISO-110)

Progress in the various research activities is described and results of investigations on the mechanical and physical properties of sintered aluminum products made in order to determine their suitability as structural materials in organic-cooled reactors are presented. NSA

N66-21941# Western Reserve Univ., Cleveland, Ohio.
LOW TEMPERATURE SPECIFIC HEATS OF AgSn ALLOYS
Ben A. Green, Jr. and Harvey V. Culbert [1964] 18 p refs
(Contract AT(11-1)-1108)
(TID-20986) CFSTI: HC $1.00/MF $0.50

The specific heats of pure Ag and Ag–Sn alloys up to 8 at.% Sn were measured between 2 and 4°K with a precision generally better than 0.5%. For pure Ag, the result is $\gamma=(0.646 \pm 0.005)$ mJ mole^{-1}°K^{-2} and the Debye temperature is (225.5 ±0.5)°K, both in good agreement with one group of previous workers. The electronic coefficient γ varies linearly vs electron-per-atom ratio e/a at the rate $d(\ln\gamma)/d(e/a)=0.22 \pm 0.06$, in agreement with Ag–Cd data. It is suggested that the available data on Cu–Zn and Cu–Ge are also consistent with this slope. The Debye temperature decreases on alloying, following a common curve vs e/a with the Ag–Cd results. The calorimetric method was unusual; repeated measurements were made at 2, 3, and 4°K only, and considerable thermal conductance was allowed between the sample and a cold reservoir. Author (NSA)

N66-21963# Battelle Memorial Inst., Geneva (Switzerland).
RESEARCH TO DETERMINE THE LONG-TERM MECHANICAL PROPERTIES OF METALS SUBJECTED TO MECHANICAL STRESS AT ELEVATED TEMPERATURES AND NEUTRON IRRADIATION Eighth Quarterly Report
W. Siegfried and S. Zimering Mar. 1965 63 p
(Contract EURATOM-100-62-12 RDS)
(EURAEC-1310) CFSTI: HC $3.00/MF $0.75

A description is given of a system of mathematical criteria that verifies if a given set of experimental data can be represented by an exponential function of real order and if the data is complete enough and without too much scatter to be so. The results of extrapolations of isothermal, isobaric, and isothermal-isobaric data are presented as a verification of the method. The physical meaning of the mathematical parameters of the exponential function are illustrated. NSA

N66-21964# Battelle Memorial Inst., Geneva (Switzerland).
RESEARCH TO DETERMINE THE LONG-TERM MECHANICAL PROPERTIES OF METALS SUBJECTED TO MECHANICAL STRESS AT ELEVATED TEMPERATURES AND NEUTRON IRRADIATION Tenth Quarterly Report
W. Siegfried and S. Zimering Oct. 1965 10 p
(Contracts EURATOM-100-62-12 RDS; EURATOM-057-64-7 TEES(RD))
(EURAEC-1488; EUR-2655) CFSTI: HC $1.00/MF $0.50

The method of thermodynamics of irreversible processes was used for time-to-rupture tests on heat-resistant, ferritic, and austenitic steels. Also the dependence of stress and temperature of the rheological parameters was determined, and it was possible to describe these values by a number of simple rate-processes which can be very easily explained physically. The application of the results to studies on scattering involved in experiments on rupture time for industrial alloys is discussed. NSA

N66-22027# Pratt and Whitney Aircraft, Middletown, Conn. Advanced Nuclear Engineering Lab.
RECOVERY AND RECRYSTALLIZATION OF COLUMBIUM AND SEVERAL COLUMBIUM–ZIRCONIUM ALLOYS
C. E. Carlson and E. J. Delgrosso Sep. 1965 29 p refs
(Contract AT(30-1)-2789)
(PWAC-465) CFSTI: HC $2.00/MF $0.50

The recovery and recrystallization characteristics of cold worked Nb and Nb–Zr alloys having nominal compositions of Nb–1 Zr, Nb–3 Zr, and Nb–5 Zr were studied. Activation energies for recovery were determined for the Nb–1 Zr, Nb–3 Zr, and Nb–5 Zr alloys. The activation energies for the initiation of recrystallization were calculated for Nb (2 interstitial levels), Nb–1 Zr (2 interstitial levels), Nb–3 Zr, and Nb–5 Zr. Electron transmission metallography of Nb–1 Zr alloy indicated that during recrystallization, complex dislocation interactions occurred which were strongly influenced by precipitates of ZrO_2. Author (NSA)

N66-22063# Cornell Univ., Ithaca, N. Y. Dept. of Engineering Physics and Materials Science.
REDISTRIBUTION OF ATOMS DURING EUTECTIC SOLIDIFICATION
H. W. Weart [1964] 44 p refs Submitted for Publication
(Contract AT(30-1)-2558)
(TID-21229) CFSTI: HC $2.00/MF $0.50

Three aspects of eutectic solidification were subjected to experimental test. First, by zone melting, the k-value of Cd in Cd–Sn and Cd–Zn was found to lie between 0.99 and 1.01, and between 0.98 and 1.02, respectively. This result is taken to indicate that it is unlikely that there can be sufficient build-up of major components in the eutectic liquid to generate the constitutional supercooling needed to cause the formation of cells. It is suggested, however, that small changes in composition of the eutectic liquid may give rise to the faults observed in lamellar eutectic structures. Secondly, from measurement of the k-value of ^{204}Tl in Cd–Zn eutectic and from microautoradiography of the solid, it is concluded that considerably more Tl impurity is incorporated into the eutectic solid thatn would be predicted by assuming the overall k-value of the composite interface to be an average of the k-values of the individual phases, weighted by their fractional areas on the cross section. Such an assumption predicts an overall k of 9×10^{-3}, but the measured value is 0.28. Details of the autoradiographic technique which is capable of resolutions of the order of 1 micron are given. Finally, additional evidence is obtained in support of the spacing-velocity relation s^2v=constant, predicted by several theories. The relative insensitivity of the value of the constant to the alloy system is taken to mean that, on a unit volume basis, all such diffusion-controlled transformations occurring close to equilibrium store about the same amount of energy in interfaces in the product per amount of energy used to carry out the transformation. Author (NSA)

N66-22066# Sandia Corp., Albuquerque, N. Mex.
WEAR TESTING OF PLATED COATINGS
C. W. Jennings Jul. 1965 32 p refs
(Contract AT(29-1)-789)
(SC-DR-65-269) CFSTI: HC $2.00/MF $0.50

An investigation was conducted to determine the wear characteristics of combinations of electroplated metals for use in rotary switches. From specimens electroplated under controlled conditions and tested for wear resistance with a wear tester which was similar in operation to a rotary switch, no apparent correlation was found between wear resistance and conditions of electroplating, other than thickness of the deposits. A thin film of soft gold (approximately 30 millionths of an inch thick) electroplated on a hard substrate of rhodium or electroless nickel or bright nickel was found to provide better wear characteristics than a rhodium-on-nickel system. A few tests were also run on gold alloy boards and ion-plated gold on alumina substrates. The latter combination, which had excellent wear characteristics, shows considerable promise for high temperature or corrosive applications.
Author (NSA)

N66-22076# California Univ., Berkeley. Lawrence Radiation Lab.
THE DILATION CONTRIBUTION TO THE HEAT CAPACITY OF COPPER AND ALPHA BRASS AT ELEVATED TEMPERATURES
Y. Austin Chang (Aerojet Gen. Corp., Sacramento, Calif.) and Ralph Hultgren Sep. 1964 22 p refs
(Contract W-7405-ENG-48)
(UCRL-11662) CFSTI: HC $1.00/MF $0.50

The compressibility as a function of temperature was measured for copper and brass (9.7 at. percent zinc) from sonic velocities. With the aid of these data the dilational contribution to the heat capacity, C_p-C_v, was calculated from 77° to 800°K. This term amounts to less than 3 percent of the total heat capacity at room temperature and below, but becomes much more important at elevated temperatures. The Nernst-Lindemann empirical equation satisfactorily predicts the dilational term for copper and the brass. For other substances, it gives a result considerably too high.
Author (NSA)

N66-22077# Oak Ridge National Lab., Tenn.
APPLICATION OF ELECTRON-MICROSCOPIC FINE-RANGE DIFFRACTION FOR THE DETERMINATION OF THE ROLLING TEXTURE OF COPPER
F. Haessner, U. Jakubowski, and M. Wilkens [1964] 17 p refs Transl. into ENGLISH from Phys. Status Solidi (West Germany), v. 7, 1964 p 701-710
(ORNL-TR-638)

The orientation of 95% cold-rolled copper relative to the rolling direction and sheet surface is determined by selected-area electron diffraction. The measurements were made on 600 spots distributed over a large area. The distribution of the poles found in this way agrees with the (111), (200), and (220) pole figures determined on the same sample by means of X-rays. A discussion is given of the additional information which can be obtained from electron microscopy as compared with the X-ray method.
Author (NSA)

N66-22099# Oak Ridge National Lab., Tenn.
COMPARATIVE X-RAY AND ELECTRON MICROSCOPY STUDIES OF THE SIZE OF GUINIER-PRESTON ZONES IN ALUMINUM-SILVER
R. Bauer and V. Gerold [1964] 11 p refs Transl. into ENGLISH from Acta Met., no. 12, Dec. 1964 p 1449-1453
(ORNL-TR-633)

A comparative investigation on the size of spherical Guinier-Preston zones in an aluminum-silver alloy has shown that the X-ray and electron-microscopic average radii do not differ by more than 10%. The differences appear to be smaller for larger zone radii (45 Å) than for smaller radii (30 Å)
Author (NSA)

N66-22124# California Univ., Livermore. Lawrence Radiation Lab.
THE CRYSTAL STRUCTURE AND THE STRUCTURAL RELATIONSHIP BETWEEN THE δ-PHASE AND γ-PHASE IN THE COPPER-TIN SYSTEM [UBER KRISTALLSTRUKTUR UND STRUKTURELLEN ZUSAMMENHANG DER PHASEN δ UND γ IM SYSTEM KUPFER-ZINN]
H. Knodler May 1965 28 p refs Transl. into ENGLISH from Metall (West Berlin), v. 18, 1964 p 1172-1177
(UCRL-TRANS-1223(L))

Samples containing 20.51 at.% Sn, quenched to room temperature from the γ-region (700°C) and the δ-region (500°C), had the stable δ-phase structure. Individual δ-phase crystals about 8 cm^3 size, quenched from the γ-region, were shown by Laue photographs to be monocrystals of homogeneous orientation, while corresponding photomicrographs indicated that they were subdivided into transition zones. The number of atoms of the unit cell in the δ-phase was found to be 416, indicating that the δ-phase is derived directly from the ordered, high-temperature γ-phase by nondiffusive transformation. A lattice model was constructed for the arrangement of atoms in the δ-phase in accordance with the relation found between the high-temperature γ-phase and the position of the atoms in Cu_5Zn_8. The diffraction angles and the intensities were calculated for 108 lines of the Debye-Scherrer diagram. Experimental and calculated values were in satisfactory agreement. Due to the structural relation between the γ- and the δ-phases, an ordered vacancy-structure was assigned to the high temperature γ-phase. The vacancy structure is characterized by N≃416 (330.7 Cu+85.3 Sn) and 16 holes on 432 lattice sites. The holes occupy 000 and 1/2 1/2 1/2 sites in the cubic lattice; each of the cubic octants have an edge of 18.3054 Å at 700°C. The 85.3 Sn atoms and 18.7 Cu atoms are distributed statistically over the remaining 104 of the 108 Sn sites of the γ-Cu_3Sn lattice. Cu atoms occupy 312 of the 324 Cu sites in the γ-Cu_3Sn lattice.
NSA

N66-22140# Battelle-Northwest, Richland, Wash. Metallurgy Research Section.
THE EFFECT OF NEUTRON IRRADIATION ON SLIPLINES IN MOLYBDENUM
J. L. Brimhall Mar. 1965 17 p refs
(Contract AT(45-1)-1830)
(BNWL-44) CFSTI: HC $1.00/MF $0.50

Slip line formation during bending was studied on neutron irradiated molybdenum single crystals. For equivalent strains, the slip lines are coarse and distinct in the irradiated molybdenum and not resolvable in the unirradiated molybdenum. Defect-free channels form in the irradiated material during deformation and the slip lines have been directly correlated with these dislocation channels. The heterogeneous distribution of the dislocations during deformation in the irradiated material results from dislocation interaction with the defects produced during irradiation. Impurities, in the form of carbides, affect the dislocation channeling by acting as dislocation sources.
Author (NSA)

N66-22143# Oak Ridge National Lab., Tenn.
CONTRIBUTION TO THE STUDY OF AGEING OF CORROSION-RESISTANT STEELS OF THE TYPE Cr18 Ni9 Ti
Karel Loebl, Hanus Tuma, and Marie Rysava [1964] 15 p refs Transl. into ENGLISH from Kovove Mater. (Czechoslovakia), v. 2, no. 5, 1964 p 433–444
(ORNL-TR-795)

Studies were made on two 18% Cr–9% Ni steels under stabilized (0.21%) and over-stabilized (0.61%) by Ti. The steels were isothermally annealed at 400 to 1000°C for times up to 10,000 hr. The structural changes taking place during annealing, especially carbide precipitation, were followed metallographically, and the individual structural componetns ere isolated electrolytically. A sigma phase is formed in areas of the delta ferrite and high Cr content. At 750–800°C, Cr carbide precipitates in the under-stabilized steel, while in the over-stabilized steel, it disappears entirely. The isolation of structural components is plotted in the form of space diagrams as functions of temperature and annealing time. The greatest effect of the annealing occurs as a drop in notch toughness. Author

N66-22158# MSA Research Corp., Callery, Pa.
EFFECT OF HIGH TEMPERATURE SODIUM ON AUSTENITIC AND FERRITIC STEELS. PHYSICAL PROPERTIES OF MATERIALS Progress Report No. 56
13 May 1965 14 p ref
(Contract AT(11-1)-765)
(MSAR-65-62) CFSTI: HC $1.00/MF $0.50

Progress is reported in the study on the effect of high temperature sodium on the physical properties of austenitic and ferritic steels. NSA

N66-22164# Los Alamos Scientific Lab., N. Mex.
SOME OBSERVATIONS CONCERNING THE MAXIMUM IN THE LATTICE PARAMETER *VS* COMPOSITION CURVE OF THE GROUP 4a CARBIDES
Edmund K. Storms [1964] 9 p refs
(Contract W-7405-ENG-36)
(LA-DC-6529) CFSTI: HC $1.00/MF $0.50

Recent reports of a maximum in the lattice parameter vs composition curves of TiC and ZrC are supported by this study. There is also an indication that this behavior is shared by HfC as well. A comparison between the X-ray and pycnometer density places an upper limit to the metal-vacancy concentration at 5±3 per 1000 metal atoms. In view of this small concentration, it is concluded that the maximum is not due to the presence of such vacancies in the lattice. Author (NSA)

N66-22263*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL THERMAL SHOCK RESISTANCE OF ZIRCONIA WITH 15 MOLE PERCENT TITANIUM
Alan Arias 18 Feb. 1965 14 p refs Submitted for Publication
(NASA-TM-X-56344) CFSTI: HC $1.00/MF $0.50 CSCL 11F

The thermal shock resistance of zirconia with 15 mole titanium prepared either by cold-pressing and vacuum-sintering or by vacuum hot-pressing was determined by radially quenching disks with thermally insulated faces under various heat-transfer conditions. The thermal shock resistance of calcia-stabilized-zirconia disks was also determined for comparison purposes. For quenches from below the transformation temperature range of zirconia, the thermal shock resistance of zirconia with 15 mole percent titanium was much better than that of calcia-stabilized zirconia, but for quenches from above the transformation range it was slightly inferior. The thermal shock resistance of zirconia with 15 mole percent titanium is fairly insensitive to the various methods of manufacture used in this investigation. Author

N66-22320*# Lockheed Nuclear Products, Marietta, Ga.
EFFECT OF NUCLEAR RADIATION ON MATERIALS AT CRYOGENIC TEMPERATURES Quarterly Report No. 2, Oct. 21, 1965–Jan. 21, 1966
C. A. Schwanbeck Feb. 1966 89 p refs
(Contract NAS3-7985)
(NASA-CR-54904; LAC-ER-8372) CFSTI: HC $3.00/HC $0.75 CSCL 11F

This is the second quarterly report for a study of the effects of nuclear radiation on materials at cryogenic temperatures. These studies include the effect of: (1) 10^{18} nvt at 30°R on tensile properties of titanium base alloys; (2) irradiation temperature (30°R to 540°R) on tensile properties of Aluminum 1099–H14 following irradiations up to 3×10^{17} nvt; (3) annealing following irradiation at 30°R to 10^{17} nvt on tensile properties of Aluminum 1099; and (4) irradiation at 30°R on axial, low-cycle fatigue properties of titanium base alloys. This report describes maintenance of and modifications to existing test equipment, required neutron flux mapping and tensile test results from Titanium 55A and partial tensile test results from Aluminum 1099. Author

N66-22327*# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
ADVANCED REFRACTORY ALLOY CORROSION LOOP PROGRAM Quarterly Progress Report No. 3, Period Ending Jan. 15, 1966
R. W. Harrison, ed. 3 Feb. 1966 33 p refs
(Contract NAS3-6474)
(NASA-CR-54911) CFSTI: HC $2.00/MF $0.50 CSCL 11F

Work progress for a program to fabricate, operate for 10,000 hrs, and evaluate a potassium corrosion test loop constructed of T-111 (Ta-8W-2Hf) alloy is reported. The program status for procurement of materials; purification and handling of alkali metals; quality assurance; and loop design are given. All of the lithium purification system drawing revisions were completed. Assembly of the argon-vacuum manifold for the lithium purification system was begun, and a hot trap was fabricated. Minor design changes were made and specifications for the T-11 Corrosion Loop I are being written. L.S.

N66-22328*# TRW Equipment Labs., Cleveland, Ohio. Materials Research and Development Dept.
GENERATION OF LONG TIME CREEP DATA ON REFRACTORY ALLOYS AT ELEVATED TEMPERATURES Tenth Quarterly Report, Sep. 26–Dec. 26, 1965
J. C. Sawyer and E. A. Steigerwald 8 Jan. 1966 60 p
(Contract NAS3-2545)
(NASA-CR-54895) CFSTI: HC $3.00/MF $0.50 CSCL 11F

Creep test data for refractory metal alloys that have use in advanced space electric power systems are presented. A summary of the chemical composition and heat treatments of the alloys discussed is presented in tabular form. Tungsten-, molybdenum-, and tantalum-base alloys were studied. The test procedure is described, and the resulting creep data are graphically presented. L.S.

N66-22345*# TRW Equipment Labs., Cleveland, Ohio.
DETERMINATION OF ELEVATED-TEMPERATURE FATIGUE DATA ON REFRACTORY ALLOYS IN ULTRA-HIGH VACUUM Sixth Quarterly Report, 1 Oct. 1965–1 Jan. 1966
C. R. Honeycutt and J. C. Sawyer 15 Jan. 1966 31 p refs
(Contract NAS3-6010)
(NASA-CR-54916) CFSTI: HC $2.00/MF $0.50 CSCL 11F

The results of fatigue tests conducted on molybdenum-base alloys (refractory) at elevated temperatures in ultra-high vacuum environments are reported. The specific material form of the TZM and TZC alloys (bar or plate), their heat numbers, and their chemical composition are given in a table. Typical microstructures of the TZC after annealing are shown in photographs. Test specimen geometries are diagrammed. Fatigue curves are plotted as functions of stress values. L.S.

N66-22355*# Marquardt Corp., Van Nuys, Calif.
INVESTIGATION OF HIGH STRAIN RATE BEHAVIOR OF REFRACTORY ALLOYS AND COATINGS Final Report
T. Miyagishima Feb. 1966 234 p refs
(Contract NAS9-4905)
(NASA-CR-65319; PR-3009-F) CFSTI: HC $6.00/MF $1.25 CSCL 11F

Selected refractory alloys, both coated and uncoated, were evaluated under the environmental loading conditions to which a rocket engine combustion chamber is subject as a result of an ignition pressure spike, in order to generate high strain rate data and establish engineering and design criteria. Emphasis was placed on determining the effects of single and repeated high dynamic strains. The following conclusions are reported: good strength and ductility resulted under high strain rate loading for Nb-10Hf-1Ti-1Zr for tensile, bend, and full scale chamber testing; good strength and reasonably good ductility also resulted for Nb-10W-10Hf. Both of these are recommended as important chamber candidate materials. It is also reported that Ta-10W materials system exhibited good strength and ductility with tensile specimens and full scale chamber testing; however the results of bend testing after torch exposure showed an appreciable loss of ductility. Finally, it is noted that the ultimate strength performance values of ductile materials, coated and uncoated, tested at high strain rates were found to be 50 to 100% higher than strength values obtained under slow strain rate conditions. D.T.

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N66-21169# Materials Research Corp., Orangeburg, N. Y.
INVESTIGATION OF ELECTRON BEAM PROCESSING OF ALUMINUM OXIDE AND RELATED MATERIALS Scientific Report No. 3
W. Class, Harvey R. Nesor, and G. T. Murray 15 Dec. 1965 refs
(Contract AF 19(628)-4089)
(AFCRL-65-908; AD-626754) CFSTI: HC $3.00/MF $0.50

This investigation deals with the application of float-zone techniques to the growth of laser ruby crystals. Two techniques, the electron beam and the hollow cathode float-zone processes, are being studied. The electron beam float-zone technique has yielded high perfection sapphire crystals free of visual scattering centers. Crystals grown by this technique show a preferred orientation of about 85 degrees as compared with flame-fusion crystals which show a 60 degrees preferred orientation. Doping of the sapphire with Cr_2O_3 has been accomplished with the aid of oxide melting point depressants. The resulting ruby, however, still exhibits optical scattering. These centers can be attributed to starting material inhomogeneity. Efforts are presently underway to improve the starting material quality. The hollow cathode float-zone technique makes use of a highly localized hollow cathode plasma to produce a molten zone. This technique is currently being developed in an effort to carry out float-zone crystal growth at pressures higher than are permissible with the electron beam technique. The technique has been developed to the stage where floating zones have been produced and scanned. Large crystals have not yet been produced; further improvements in plasma stability must be accomplished before large crystals can be grown by this technique.
Author (TAB)

N66-21198# Army Electronics Labs., Fort Monmouth, N. J.
ELECTRONICALLY FUNCTIONAL ORGANIC MATERIALS
Gerhardt Platau, Wayne R. Wenger, and Emile Beekman Sep. 1964 37 p refs
(ECOM-2508; AD-609831) CFSTI: HC $2.00/MF $0.50

The syntheses of fourteen compounds based on ferrocene, nickelocene, and cyclopentadiene are described. The infrared spectra for these compounds are shown. Conductivity and electron spin resonance absorption measurements performed on these and twelve other compounds obtained from external sources indicate poor electronic activity for most of these materials. The application of these compounds and organic compounds in general as active elements in electronic devices is discussed. Author (TAB)

N66-21266# Mellon Inst., Pittsburgh, Pa.
POLYMER STRUCTURES AND PROPERTIES Technical Documentary Report, 1 Jan.–31 Dec. 1964
G. C. Berry, T. G. Fox, E. F. Casassa, T. A. Orofino, J. W. Mickey, Jr. et al Wright-Patterson AFB, AF Mater. Lab., Oct. 1965 166 p refs
(Contract AF 33(657)-10661)
(ML-TDR-64-286, Pt. II; AD-626188) CFSTI: HC $5.00/MF $1.00

The physical properties of ring and linear chain polymers in dilute solutions were investigated; and a critical analysis of viscometric tests of theories of the effect of intramolecular volume exclusion upon chain dimensions in good solvents was carried out. In a continuing study of polystyrene solutions, it was found that the ratio of the intrinsic viscosity in a good solvent to that in a theta solvent does not depend uniquely on the expansion of the rms molecular radius. Viscometric and thermodynamic measurements on several star and comb branched polystyrenes yielded results qualitatively in accord with expectations. Solution measurements on fractionated Bisphenol A polycarbonate showed that its chain is extremely flexible in the sense that the molecular unperturbed radius is only 10 to 30% greater than the calculated value for completely free rotation about carbon–carbon and carbon–oxygen bonds. Work is also reported on modifications to a concentric cylinder viscometer, the use of a potassium

anion-radical in the preparation of atactic polymethyl methacrylate, and a preliminary investigation of the properties and preparation of polymethacrylic anhydride. D.T.

N66-21317# Army Weapons Command, Rock Island, Ill. Research and Engineering Div.

A NEW METHOD FOR THE ANALYSIS OF VOLATILE CORROSION INHIBITED PAPER

Peter Martin, Jr. Nov. 1965 25 p refs
(RIA-65-3105; AD-626584) CFSTI: HC $1.00/MF $0.50

The method utilized a commercial instrument, the Corrator, which measures instantaneous corrosion rates in a conducting media. Laboratory and field tests were conducted on new and used VCI paper to establish the reliability and accuracy of the method. The VCI papers were analyzed by adding a paper sample to the salt solution, stirring to remove the VCI, and noting the decrease in the corrosion rate. The decrease in the corrosion rate was converted to weight of loading (grams per square foot) by means of the standard curves previously prepared. The results obtained compared favorably with results obtained by other more tedious analytical methods. The method developed has the following advantages: utilizes a stable reagent, nontechnical personnel can conduct the test, the instrument is battery operated and the test time is less than one hour. TAB

N66-21386# Naval Ordnance Lab., White Oak, Md. Chemistry Research Dept.

THE EFFECT OF RADIATION ON THE ELECTRICAL RESISTIVITY AND BULK COMPRESSIBILITY OF POLYEPOXIDES

R. W. Warfield and C. V. Kincaid 13 Dec. 1965 30 p refs
(NOLTR-65-125; AD-627049) CFSTI: HC $2.00/MF $0.50

Three polyepoxides were exposed to varying doses of mixed neutron and gamma radiation in the University of Maryland nuclear reactor. Before irradiation, the electrical volume resistivity and the bulk compressibility of each of the polymers were determined as a function of temperature. The changes produced in these two parameters by radiation doses up to 25 Mrads were progressively followed by measurements after each radiation cycle. The results of this study indicate that radiation of this type and intensity will degrade crosslinked polyepoxides and that this can be shown by electrical resistivity measurements and by changes in the bulk compressibility. Author (TAB)

N66-21387# Naval Ordnance Lab., White Oak, Md.

HIGH TEMPERATURE RESISTANT MATERIALS FOR MISSILE PROPULSION SYSTEMS Summary Report, 30 Jun. 1964–30 Jun. 1965

B. T. Hartmann, F. J. Koubek, and D. M. Caum 29 Nov. 1965 35 p refs
(NOLTR-65-208; AD-627519) CFSTI: HC $2.00/MF $0.50

Parametric studies were completed on methods for computing thickness of heat shield needed for a given set of conditions. For two very different materials, the studies showed that total insulation thickness needed is not sensitive to the exact value of the front-face temperature. Furthermore, whereas an average value of effective thermal diffusivity is sufficiently accurate for these calculations, the actual variation of heat flux with time must be used. One preliminary check of the above method against experimental data gave satisfactory agreement within 7%. A total of seven typical ablation materials was tested in the oxyacetylene burner using the alpha-rod technique. The results are in general agreement with previous arc image furnace data but are more precise, primarily due to the accuracy of the automatic feed device as compared with manual operation. Design work on the hi-pressure gas stabilized hi-intensity plasma arc head was almost completed. Most of the extensive auxiliary equipment has been obtained or requested. Author (TAB)

N66-21395# Army Weapons Command, Rock Island, Ill. Research and Engineering Div.

EFFECT OF WATER AND PARTICULATE CONTAMINANTS ON POLYMER SHEAR STABILITY

R. L. Le Mar Jan. 1966 19 p refs
(RIA-66-208; AD-628073)

Polyisobutylene and polymethacrylate viscosity index improver additives were tested in oil solution for shear stability by the sonic irradiation technique, with and without added water and solid particle contaminants. The shear breakdown of polyisobutylene was significantly reduced at low water concentrations and nearly completely blocked at high water concentrations. The shear stability of the polymethacrylate solutions was not significantly affected by water. Neither polymer's stability was affected by particulate contamination. It was concluded that sonic shear methods may be used in the presence of solid particle contaminants and in the presence of water contaminants for shear stability determinations on polymethacrylate-oil solutions. Insofar as sonic shear methods reflect shear stresses on hydraulic oils, these results indicate that such contaminants would not adversely affect polymer shear stability at the low concentration levels normally found in such oils. Author (TAB)

N66-21445# Office of Naval Intelligence, Washington, D. C. Translation Section.

EPOXY COMPOUNDS AND THEIR APPLICATION

K. I. Chernyak [1959] 194 p refs Transl. into ENGLISH of a Russian pam., Leningrad, State Union Publishing House for the Shipbuilding Ind., 1959
(ONI-TRANSL-775; AD-628008) CFSTI: HC $5.00/MF $1.00

Contents: Epoxy resins and hardeners, (technology of production, basic characteristics of dianin resin, hardening agents, methods of determination of the vitality of the epoxy compounds); Epoxy compounds, (classification, plasticizers and fillers, characteristics of the process of hardening, recipes for epoxy compounds and some of their peculiarities); Properties of epoxy compounds, (physico-chemical, mechanical, and electrical properties, epoxy compounds as heat-stable electrical insulation); Some varieties of epoxy compounds, (epoxy-thioko compound, foam epoxys, glues); Preparation and utilization of epoxy compounds, (technology of preparation and utilization safety techniques, several methods of utilizing epoxy compounds). TAB

N66-21589# Verfinstituut TNO, Delft (Netherlands).

METHOD FOR DETERMINATION OF BLEEDING OF DRIED PAINT LAYERS [METHODE TER BEPALING VAN HET BLOEDEN VAN GEDROOGDE VERFLAGEN]

9 Feb. 1966 9 p In DUTCH
(V-66-49; TDCK-44723) CFSTI: HC $1.00/MF $0.50

Experiments were conducted on red synthetic lacquers and red nitrocellulose lacquers to determine the amount of bleeding which occurred in dried paint layers. The red lacquers were sprayed on a plate, with transparent tape applied in certain areas to prevent bleeding. A white lacquer mixed with lacquer benzine–xylene for spraying consistency was

applied to the synthetic red lacquer. The nitrocellulose lacquer was sprayed with a white cellulose lacquer which was mixed with a thinner consisting of ethylacetate, M.I.B.K., butanol, isopropylalcohol, and toluene. Results indicate that the synthetic lacquer had no tendencies toward bleeding, whereas the nitrocellulose lacquer underwent minor bleeding. It was shown, however, that this small amount of bleeding was largely due to the length of drying time of the original red color. Transl. by J.O.

N66-21636# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHEMICAL FIBERS Selected Articles
13 May 1965 25 p refs Transl. into ENGLISH from Khim. Volokna (Leningrad), no. 6, 1963 p 6-9; 31-34
(FTD-TT-65-22/1+2; AD-615982) CFSTI: HC $1.00/MF $0.50

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1. EFFECT OF POLYMER PROPERTIES ON PHYSICO-MECHANICAL PROPERTIES OF POLYACRYLONITRILE FIBER N. M. Beder and A. B. Pakshver p 1-10 refs (See N66-21637 11-18)

2. POLYAMIDE ESTERS AND FIBERS ON THEIR BASE L. F. Balakleytseva, A. I. Koratskaya, and G. I. Kudryavtsev p 11-21 refs (See N66-21638 11-18)

N66-21637 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF POLYMER PROPERTIES ON THE PHYSICO-MECHANICAL PROPERTIES OF POLYACRYLONITRILE FIBER
N. M. Beder and A. B. Pakshver *In its* Chem. Fibers 13 May 1965 p 1-10 refs Presented at 2d Conf. on the Probl. of Studying the Properties of Polyacrylonitrile Fiber (See N66-21636 11-18) CFSTI: HC $1.00/MF $0.50

This report describes an investigation conducted to explain the effect of acid and basic groups in the polyacrylonitrile (PAN) macromolecule on the properties of concentrated PAN solution in dimethyl formamide and fiber, obtainable from this solution. The study showed that as the number of low molecular fraction rise, the fiber strength rises. When fiber is formed from a polymer with basic end groups, this rise in strength is greater than for fibers made of polymers with acid end groups. The homogeneity of spinning solutions rises with an increase in content of low molecular fractions for polymers with basic groups, but decreases for polymers with acid end groups. Homogeneity of spinning solutions made of PAN with basic groups is higher than with acid ones. The breaking elongation of fiber, obtained from polymers of both types, is identical, provided the spinning solutions of the polymer with acid groups are prepared in the presence of oxalic acid. Otherwise elongation of the fiber formed from polymers with acid groups is higher. R.N.A.

N66-21638 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POLYAMID ESTERS AND FIBERS ON THEIR BASE
L. F. Balakleytseva, A. I. Koratskaya, and G. I. Kudryavtsev *In its* Chem. Fibers 13 May 1965 p 11-21 refs (See N66-21636 11-18) CFSTI: HC $1.00/MF $0.50

The synthesis of fiber forming polyamidoesters and the properties of the fibers obtained from them are investigated. Methods for the synthesis of polyamidoesters are described. Fibers were obtained from AG salt, dimethyterephthalate (DMT) and ethylene glycol (EG), aminoenanthic acid (AEK), DMT and EG base polyamidoester (PAE) at ratios ranging from 99.1:0.1 to 95.5. The prepared fibers were subjected to physico-mechanical and thermo-mechanical studies; graphs of the plotted thermo-mechanical curves are shown. Melting points and specific viscosities of AG salt, DMT and EG base polymers are listed. It was established, that with a rise in the amount of ester groups in polyamidoester on AEK, DMT and EG base from 1 to 4 mol. % improved the elastic properties, modulus of elasticity rise, and the bitrification point of the fiber rises. M.R.W.

N66-21732# Max-Planck-Institut für Physik und Astrophysik, Munich (West Germany).
ULTRAVIOLET WINDOWS AND FILTERS FOR THE SPECTRAL REGION BETWEEN 1000 Å AND 3000 Å
G. Boldt Paris, European Space Res. Organ., Nov. 1965 14 p refs
(ESRO-SM-6) CFSTI: HC $1.00/MF $0.50

A somewhat arbitrary choice of window and filter materials, transparent in the region between 1000 Å and 3000 Å, is presented in this memorandum, as well as a short description of their properties, a listing of their commercial sources and, finally, the literature references used. Although certain materials are very interesting because of their ultraviolet transmission properties (e.g., NaCl, KBr etc.), their hygroscopic behavior makes them unsuitable for use in windows and filters. Author

N66-21741# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
PHENOLIC RESINS MODIFIED BY SOME MINERAL ADDITIONS [RESINES PHENOLIQUES MODIFIEES PAR DES ADDITIONS MINEARALES]
Samuel Kohn 1966 36 p refs In FRENCH Presented at the Colloq. on Materials for Space Use, Paris, 7-11 Feb. 1966 (ONERA-TP-324(1966)) CFSTI: HC $2.00/MF $0.50

After having summarized the results of a previous study on thermal stability of phenol resins containing various mineral additions, we describe the influence of such additions on the thermostability of two resins in an inert oxidation medium at atmospheric pressure. By exposing phenol resins to 400° and 450°, we succeed in rendering these materials quite resistant to heating. Similar thermal stability without heating at high temperature was obtained by the addition of a moderate quantity of a hydroxide mineral. Author

N66-21780°# Notre Dame Univ., Ind. Dept. of Chemistry.
FUNDAMENTAL STUDIES ON THE SYNTHESIS OF HEAT-RESISTANT POLYMERS. SOME PARAMETERS IN THE EVALUATION OF THE THERMAL STABILITY OF POLY (p-XYLYLIDENE-p-PHENYLENEDIAMINE) Progress Report No. 9, 15 Sep. 1965-31 Jan. 1966
G. F. D'Alelio 15 Feb. 1966 69 p refs
(Grant NsG-339)
(NASA-CR-71541) CFSTI: HC $3.00/MF $0.75 CSCL 11I

The substitution of helium for nitrogen in TGA measurements yield substantially the same values for the thermal stability of poly(p-xylylidene-p-phenylenediamine). The respective thermal stability values in nitrogen and in air are unchanged over a fourfold change in gas flow rate or changes in heating rate over the range of 5°C to 30°C per minute. Higher apparent thermal stabilities are observed when the polymer sample of 10 milligrams is evaluated as a single mass rather than as a powder. Infrared spectral studies confirm the Schiff base character of the polymer, and that heating to 600°C causes chain extension. Mass spectral studies

derived from heating the polymer to temperatures above 600°C show the products of eliminated benzylideneaniline and hydrogen. Calorimetric measurement of the polymer heated to 1000°C were compared to similar measurement of pyrolytic graphite and the conclusion made that graphitization has not occurred in the polymer. A comparison of the thermograms before irradiation and after irradiation of the polymer indicate that they are highly resistant to irradiation. Author

N66-21809*# Monsanto Research Corp., Dayton, Ohio.
DEVELOPMENT OF IMPROVED PLASTIC FOAM GENERATING AGENTS AND TECHNIQUES FOR SATURN APPLICATIONS Final Report, Jul. 1964–Jun. 1965
C. L. Bellanca, I. O. Salyer, R. T. Jefferson and B. R. Hickman [1965] 154 p refs
(Contract NAS8-11373)
(NASA-CR-71525) CFSTI: HC $4.00/MF $1.00 CSCL 11I

A mathematical analysis of the compressive strength of foam systems was conducted and a factor was derived which allowed foam strength to be evaluated independently of foam density. Solid urethane castings were prepared in order to screen candidate polymer systems so that the more promising high strength and modulus products for further evaluation as foams could be selected. Prepolymer and "one-shot" methods of foam preparation were investigated. A "one-shot" foam system was developed encompassing the one- to ten-pound per cubic foot density range. Heterogeneous foams, consisting of a low density foam matrix reinforced with "strands" of high-density foam and foams containing low-density fillers or holes, were prepared and tested for strength-at-density properties. Author

N66-22006# Union Carbide Corp., Parma, Ohio. Carbon Products Div.
EFFECTS OF NEUTRON DAMAGE ON THE MECHANICAL PROPERTIES OF PYROLYTIC AND SINGLE CRYSTAL GRAPHITE Semiannual Progress Report, 1 Jan.–30 Jun. 1965
J. T. Meers 5 Nov. 1965 63 p refs
(Contract AT(40-1)-3237)
(TID-22420) CFSTI: HC $3.00/MF $0.75

Pre-irradiation testing of compression-annealed pyrolytic graphite was completed. A set of elastic compliance and stiffness constants was obtained for compression-annealed pyrolytic graphite. In addition, the behavior of this material when subjected to shear is described and the stress-strain curve for shear is given. Values for shear strength of single-crystal graphite are also given. Work has continued on the problem of measuring the tensile strength of single-crystal graphites. Author (NSA)

N66-22255*# General Electric Co., Philadelphia, Pa.
THE OXIDATION AND SUBLIMATION OF GRAPHITE IN SIMULATED RE-ENTRY ENVIRONMENTS
J. W. Metzger, M. J. Engel, and N. S. Diaconis [1965] 91 p refs Presented at the 18th Ann. Meeting of Heat Transfer and Fluid Mech. Inst., Los Angeles, 21–23 Jun. 1965
(Contracts SNPC-10; AF 04(694)-222)
(NASA-CR-60395) CFSTI: HC $3.00/MF $0.75 CSCL 11B

An experimental study of the oxidation and sublimation of two types of graphite in simulated reentry environments is described. The two graphites are ATJ, a fine grain commercial graphite, and pyrolytic graphite, a highly anisotropic material produced by vapor deposition. The experimental program is described, the data analysis techniques used to obtain the various correlations are presented, and the comparison of the results with the theoretical treatments of Scala are shown. R.N.A.

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N66-21127# Weapons Research Establishment, Salisbury (Australia).
THE TRACING OF RADIO WAVES IN THE IONOSPHERE
M. G. Golley Feb. 1965 44 p refs
(WRE-PAD-96) CFSTI: HC $2.00/MF $0.50

This note describes a method for tracing radio waves in the ionosphere, in the presence of the earth's magnetic field. The method consists of solving a set of differential equations, whose solutions give the position of the ray as a function of the ray path length. The equations were derived by Haselgrove in 1954, and their application, in a simplified form, was made in 1957. An IBM 7090 program, Number IG6.17.10 has been written to give the general solution to the problem, and the results of several ray tracings are presented. Author

N66-21190# College of Aeronautics, Cranfield (England).
A CLASS OF NONLINEAR DIFFERENTIAL EQUATIONS WITH EXACT SOLUTIONS
P. A. T. Christopher Nov. 1965 17 p refs
(CoA-AERO-187) CFSTI: HC $1.00/MF $0.50

Exact solutions were previously obtained to a class of nonlinear differential equations of second order which are closely similar in form to equations arising in physical applications. The present paper extends these results to a wider class in which the equation may be of any order and in which there is a greater freedom of choice of the coefficients. As an application these results are used to test certain stability criteria arising from the use of Lyapunov's direct method. Author

N66-21230# State Univ. of New York, Stony Brook. Coll. of Engineering.
A TABLE OF DISTRIBUTIONAL MELLIN TRANSFORMS: I Scientific Report No. 6
Timothy A. Loughlin 15 Jun. 1965 86 p refs *Its* Rept.-40
(Contract AF 19(628)-2981)
(AFCRL-65-645; AD-625915) CFSTI: HC $3.00/MF $0.75

A list of distributional Mellin transforms is derived. Singular distributions that are considered include delta functionals and pseudofunctions obtained from Hadamard's Finite Part. The ordinary distributions include algebraic and elementary transcendental functions. Proofs or derivations are provided for all results. Author

N66-21313 Air Force Academy, Colo. Frank J. Seiler Research Lab.
COMPUTATIONAL PROCEDURES FOR SENSITIVITY COEFFICIENTS IN TIME-INVARIANT MULTIVARIABLE SYSTEMS

Bernard S. Morgan, Jr. 13 Oct. 1965 20 p refs
(SRL-65-0004; AD-625010) CFSTI: HC $1.00/MF $0.50

This paper considers a linear time-invariant multivariable (multiple input–output) system represented by a system of first-order differential equations. Procedures, which can be easily programmed on a digital computer, are presented for the determination of: (1) the system transfer-function matrix; (2) sensitivity coefficients for the transfer-function matrix in terms of system parameters.

Author (TAB)

N66-21335# Cincinnati Univ., Ohio.
A SURVEY OF ASYMPTOTIC SERIES SOLUTIONS TO THE BOUNDARY LAYER EQUATIONS Interim Report, Jun. 1964–Jun. 1965
Ting Y. Li and Philip S. Kirk Wright-Patterson AFB, Ohio. ARL, Dec. 1965 37 p refs
(Contract AF 33(616)-8453)
(ARL-65-244; AD-628287) CFSTI: HC $3.60/MF $0.50

The paper presents a summary of the asymptotic series method for solving approximately the boundary layer equations. The principles and restrictions of the method are discussed in detail, together with a brief survey of the previous papers that have utilized this method. The present discussion indicates the types of boundary layer problems that are susceptible to this treatment, and the reasons for these limitations. The mathematical techniques upon which these analyses rely, such as the method of steepest descent, and the Euler Transformation, are treated in detail and are related to the aforementioned limitations. Also the use of asymptotic series together with numerical computer calculations is discussed briefly, indicating possible lines of advancement.

Author (TAB)

N66-21344# Harry Diamond Labs., Washington, D. C.
TABLES OF BEST TCHEBYCHEFF APPROXIMANTS FOR TIME-DELAY SIMULATION
Arthur Hausner and Cita M. Furlani 30 Dec. 1965 48 p refs
(HDL-TM-65-58; AD-628219) CFSTI: HC $2.00/MF $0.50

This report presents tables of all-pass rational fraction transfer functions that approximate a time delay τ to within an error ϵ for frequencies ω such that $0 \leq \omega\tau \leq k$. The coefficients are optimized to maximize the bandwidth, k, given the order n of the transfer function and the error ϵ. TAB

N66-21374# ARO, Inc., Arnold Air Force Station, Tenn.
NUMERICAL INTEGRATION OF FIRST-ORDER STIFF DIFFERENTIAL EQUATIONS
F. C. Loper and W. J. Phares Arnold Eng. Develop. Center, Feb. 1966 19 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-65-262; AD-628091) CFSTI: HC $1.00/MF $0.50

A method is presented for numerically integrating a system of stiff, first-order differential equations. This method is based on transforming the set of dependent variables so that the resulting system will not be stiff; the transformed system is then integrated by the Runge-Kutta method. The resulting procedure is often appreciably faster than classical methods in that a much larger step size is allowable with nominal increase in step computation time. Applications and results are discussed for systems of various order, including a system of six chemical rate equations. Author (TAB)

N66-21383 California Univ., Berkeley. Operations Research Center.
A GEOMETRIC DUALITY THEOREM WITH ECONOMIC APPLICATION
David Gale Dec. 1965 18 p ref
(Contract Nonr-222(83))
(ORC-65-32; AD-626728) CFSTI: HC $1.00/MF $0.50

Let S be a surface in a normed linear space which is the graph of a concave function. At each point x of S there is a supporting linear function and the Duality Theorem states that there is one such function of smallest norm and this norm is equal to the 'steepness' of the surface at x. The result is used to give economically meaningful, necessary and sufficient conditions for the validity of the Kuhn-Tucker Theorem and also to provide an estimate of the Kuhn-Tucker prices relating them to the marginal productivity of capital. Author (TAB)

N66-21432# Washington Univ., Seattle. Dept. of Mathematics.
COHOMOLOGY AND DEFORMATIONS IN GRADED LIE ALGEBRAS
Albert Nijenhuis and R. W. Richardson, Jr. May 1965 55 p refs
(Contract Nonr-477(15); Grant NSF GP-1905)
(TR-24; AD-615146) CFSTI: HC $2.00/MF $0.50

The theories of deformations of associative algebras, Lie algebras, and of representations and homomorphisms of these all show a striking similarity to the theory of deformations of complex analytic manifolds. The common context of all these turns out to be the problem of deforming one single element x of degree one in a graded Lie algebra subject to the conditions $[x,x]=0$. The first part of this report gives general properties of graded Lie algebras over fields of characteristic not 2; the second part deals with the case of characteristic 2. The third and fourth parts give general theorems on deformability for the respective cases when the base field is the real or complex numbers (analytic methods), and general algebraically closed fields (algebraic methods). It is shown that deformability is to a large extent determined by certain cohomology groups and mappings of these. Author

N66-21467# Michigan Univ., Ann Arbor. Coll. of Literature, Science, and the Arts.
HOMOMORPHISMS OF GRAPHS
Stephen Hedetniemi Dec. 1965 193 p refs *Its* Rept.-03105-42-T
(Contract Nonr-1224(21); Grant DA-ARO(D)-31-124-G665)
(AROD-4049-17; AD-627682) CFSTI: HC $3.00/MF $0.75

The works of Hartmanis and Stearns, Krohn and Rhodes, Yoeli and Ginzburg, and Zeiger amply demonstrate the usefulness of homomorphisms in studying decompositions of finite automata. Yoeli and Ginzburg's approach is slightly different from the others in that it is more concerned with aspects of the state transition graphs of finite automata. In their paper, 'On Homomorphic Images of Transition Graphs,' they give a complete characterization of the class of homomorphisms of the graphs which correspond to input-free automata. This paper was motivated by an interest in extending these results of Yoeli and Ginzburg in the direction of a characterization of the class of homomorphisms of graphs which correspond to arbitrary finite automata. It is a review and a classification of most of the published definitions and results on mappings of graphs which have been called homomorphisms. The paper contains, in addition, several new results and several new definitions of homomorphisms of graphs.

Author (TAB)

N66-21481# Ampex Corp., Redwood City, Calif.
SELF-ACTING FOIL BEARINGS OF INFINITE WIDTH
Edward J. Barlow Jan. 1966 25 p refs
(Contract Nonr-3815(00) (X))
(RR-65-14; AD-628021) CFSTI: HC $1.00/MF $0.50

The minimum gap between a rigid cylinder and a moving foil (or between a rotating cylinder and a stationary foil) is determined as a function of the wrap angle as well as of the foil speed and tension, the cylinder radius, and the viscosity of the lubricant. Author (TAB)

N66-21652*# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
LIE SERIES SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS Administrative Report No. 1, 1 Jul.–31 Dec. 1965
F. Cap [1966] 9 p
(Grant NGR-52-046-001)
(NASA-CR-71403) CFSTI: HC $1.00/MF $0.50 CSCL 12A

Progress is reported for a program which is attempting to obtain Lie solutions for the 33 equations resulting from the separation of the Helmholtz equation into 11 coordinate systems. A separation of the Helmholtz equation in elliptic cylinder components has led to the consideration of Mathieu functions and their expansion into a Fourier series. The investigation aimed at finding a general code for these 33 equations has involved the use of Laplace transformation and the Bessel equation. M.W.R.

N66-21672 International Business Machines Corp., San Jose, Calif. Research Lab.
ESTIMATES FOR TRUNCATION ERRORS OF INFINITE DIMENSIONAL SYSTEMS OF LINEAR ORDINARY DIFFERENTIAL EQUATIONS
M. L. Bandy and P. K. C. Wang *In its* Papers on the Control of Distributed Parameter Aeroelastic Systems Nov. 1965 p 107–126 refs (See N66-21666 11-01) CFSTI: HC $5.00/MF $1.00

The problem of determining the motion of distributed parameter dynamical systems governed by partial differential equations can often be reduced to that of solving a denumerably infinite system of ordinary differential equations. Although approximate solutions can be obtained by using various closure techniques, their usefulness depends to a large extent on whether error estimates can be obtained. In this section, explicit estimates for the truncation errors associated with particular classes of infinite systems of first and second order linear ordinary differential equations are obtained. The results are applied to a system arising in a distributed parameter control process. Author

N66-21673 International Business Machines Corp., San Jose, Calif. Research Lab.
AN IMPROVED ESTIMATE FOR THE ERROR OF TRUNCATION FOR AN INFINITE SYSTEM OF ORDINARY DIFFERENTIAL EQUATIONS
M. L. Bandy *In its* Papers on the Control of Distributed Parameter Aeroelastic Systems Nov. 1965 p 127–140 (See N66-21666 11-01) CFSTI: HC $5.00/MF $1.00

Many of the partial differential equations arising from physical problems may be reduced to an infinite system of ordinary differential equations. An approximate solution of the original partial differential equation can be obtained from the infinite system by truncation. In this section some explicit estimates for the error of this type of approximation are obtained. An extension of Gronwall's Lemma is also proved. This section is an extension of a previous paper by the author and P. K. C. Wang, "Estimates for Truncation Errors of Infinite Dimensional Systems of Linear Ordinary Differential Equations," IBM Research Report, 1964. Author

N66-21757# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
USE OF YU. D. SOKOLOV'S METHOD IN SOLVING NEUMANN'S EXTERNAL PROBLEM FOR POISSON'S EQUATION [PRO ZASTOSUVANNYA METODY YU. D. SOKOLOVA DO ROSV'YAZANNYA ZOVNISHN'OI ZADACHI NEYMANA DLYA RIVNYANNYA PUASSONA]
A. Yu. Luchka Jan. 1966 8 p Transl. into ENGLISH from Dopovidi Akad. Nauk Uk. RSR (Kiev), no. 5, 1965 p 547–550 (TC-980; AD-627860) CFSTI: HC $1.00/MF $0.50

A class of linear equations in full Hilbert space is considered, and the method for designating the approximations is given. Relative to this, a method of analytical extension is compared with the Sokolov method, and a table is given which shows that the fourth approximation found by the proposed method coincides with the accurate solution. M.G.J.

N66-21760# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
USE OF YU. D. SOKOLOV'S METHOD IN SOLVING DIRICHLET PROBLEM FOR POISSON'S EQUATION [PRO ZASTOSUVANNYA METHODY YU. D. SOKOLOVA DO ROZV'YAZANNYA ZADACHI DIRIKHLE DLYA RIVNYANNYA PUASSONA]
A. Yu. Luchka Jan. 1966 6 p Transl. into ENGLISH from Dopovidi Akad. Nauk Uk. RSR (Kiev), v. 4, 1965 p 426–429 (TC-979; AD-627859) CFSTI: HC $1.00/MF $0.50

The solving of Dirichlet's internal problem for Poisson's equation by the method of potentials leads to Fredholm's linear integral equation of the second type. The present work shows that Sokolov's method used for such a class of integral equations is always coinciding and reliable with respect to round-off errors. TAB

N66-21777*# North Carolina Univ., Chapel Hill. Computation Center.
RESEARCH STUDY TO DEVELOP METHODS FOR SOLVING PROBLEMS ASSOCIATED WITH SPACE VEHICLES Monthly Progress Report (Final)
Betty Gail Woodward 22 Feb. 1966 58 p refs
(Contract NAS8-20106)
(NASA-CR-71546) CFSTI: HC $3.00/MF $0.50 CSCL 12A

Algebraic simplification for the computer was investigated. An algorithm was developed for expressing the product of trigonometric functions as the sum or difference of other trigonometric functions. This required additional algorithms to substitute for trigonometric functions of negative arguments, positive arguments, and zero argument. The following algorithms were developed: (1) automatic simplification, (2) factoring, (3) multiplication, (4) grouping, (5) power expansion, (6) trigonometric multiplication, (7) trigonometric sign, (8) trigonometric value, and (9) zero-one simplification algorithms. These were developed as subroutines to an Erahn algorithm which transforms a parentheszed expression into a parenthesis free form. The functions of the algorithms, the application of the mathematic relationships, and the mechanisms and details of the algorithms are discussed. N.E.H.

N66-21848# California Univ., Berkeley. Inst. of Engineering Research.
ON THE GEOMETRY OF OPTIMAL PROCESSES, PART I
A. Blaquiere and G. Leitmann Jun. 1964 117 p refs
(Grant NSF GP-803)
(AM-64-10)

The geometric properties of optimal processes are discussed. The discussion is deliberately denumerative, i.e., various cases which arise are treated separately in order to expose their special features. This approach yields the Maximum Principle of Pontryagin, however, it should be noted that this result is incidental, and the emphasis is on the geometry of optimal processes. This report deals with autonomous systems which are transferred between fixed end points, and for which the control variables belong to a given, constant set. M.R.W.

N66-21926# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
A METHOD OF CONSTRUCTING CERTAIN CLASSES OF SOLUTIONS FOR CHEW-LOW TYPE EQUATIONS [METOD POSTROENIYA NEKOTORYKH KLASSOV RESHENII URAVNEII TIPA URAVNEMII CHU-LOU]
V. A. Meshcheryakov 1965 32 p refs In RUSSIAN
(JINR-P-2369)

A method is suggested to construct certain solutions of equations of the Chew-Low type. The solutions have a finite number of poles. The extent to which general solutions of these equations are not unique is clarified. It is shown that by using the non-uniqueness of the solutions it is possible to construct a whole class of solutions for the Chew-Low equations. Author (NSA)

N66-21986# Pittsburgh Univ., Pa. Div. of Natural Sciences.
APPROXIMATE METHODS FOR SOLVING LINEAR AND NON-LINEAR MULTIDIMENSIONAL INTEGRAL EQUATIONS AND BOUNDARY VALUE PROBLEMS
Ivan Itkin (Ph.D. Thesis) 1964 297 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-7-1764) CFSTI: HC $6.00/MF $1.50

Approximate methods are presented for solving general forms of integral equations, linear or nonlinear, possessing an arbitrary finite number of dimensions adaptable to electronic digital computation. The major emphasis is placed upon developing and classifying methods which can be applied to multidimensional non-linear integral equations. Included is a discussion of replacement formulas for integrals, and an examination of the stability characteristics of a step-by-step process for solving integral equations with variable limits. General classes of steady-state and time-dependent boundary value problems are shown each to possess a compact representation in the form of an integro-differential equation which includes the boundary conditions. Appropriate methods are discussed for obtaining their solutions. This representation has the advantage of providing solutions for any simply closed analytic region and is not restricted, as it would be in differential form, to simple geometries. It has also been suggested that discrete variable methods of solution are more stable when applied to integral rather than differential forms of boundary value problems. Author (NSA)

N66-21999# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
THE EXPANSION OF A FUNCTION IN TERMS OF CHEBYSHEV POLYNOMIALS USING THE I.B.M. 7040
P. A. E. Hawker and N. W. Ridgway Jun. 1965 27 p ref
(AAEC/TM-293)

A digital computer program for expanding a function in terms of Chebyshev polynomials is described. The functions considered are assumed to be continuous and known at only a finite number of points. The coefficients of the Chebyshev polynomial expansion and those of the corresponding power polynomial are determined. Author (NSA)

N66-22039# Sandia Corp., Albuquerque, N. Mex.
THE THEORY OF CONES
D. R. Morrison, Mar. 1965 49 p refs
(Contract AT(29-1)-789)
(SC-R-65-870) CFSTI: HC $2.00/MF $0.50

The theory of cones in the group theoretical context is reviewed. The topics studied include cones of functions with slope, subsets of groups, generalized cosets, cones of subsets and convex subsets, classification of cones and cone homomorphisms, cones of automorphisms, and monoganic cones. NSA

N66-22046# Sandia Corp., Albuquerque, N. Mex.
ON INTEGER LINEAR PROGRAMMING IN COMBINATORIAL ANALYSIS
R. E. Woolsey (M.A. Thesis—Texas Univ.) Aug. 1965 81 p refs
(Contract AT(29-1)-789)
(SC-R-65-963) CFSTI: HC $3.00/MF $0.75

Certain classes of problems in combinatorial analysis are easily expressible in forms suitable for linear programming. However, linear programming is not used extensively in problems of this type. The principal difficulty is the common restriction in such problems that some (or all) of the solution variables are required to take on only integer values. A computer-oriented method is defined for attacking a problem of the above type. Author (NSA)

N66-22088# Sandia Corp., Albuquerque, N. Mex.
APPROXIMATE SOLUTIONS OF SYSTEMS OF NONLINEAR EQUATIONS
C. L. Greer [1965] 12 p Presented at the Rio Grande Chapter Meeting, Assoc. for Computing Machinery, Phoenix, Ariz.
(Contract AT(29-1)-789)
(SC-DC-65-1428; CONF-650527-1) CFSTI: HC $1.00/MF $0.50

A technique for solving nonlinear algebraic and transcendental equations is presented. It is applied to the general n-dimensional problem $F(X)=0$. The use of the technique is illustrated in a nonlinear least-squares data fitting problem. NSA

N66-22142# Los Alamos Scientific Lab., N. Mex.
A FORTRAN VERSION OF NORDSIECK'S SCHEME FOR THE NUMERICAL INTEGRATION OF DIFFERENTIAL EQUATIONS
H. R. Lewis, Jr. and E. J. Stovall, Jr. 22 Jun. 1965 36 p refs
(Contract W-7405-ENG-36)
(LA-3292) CFSTI: HC $2.00/MF $0.50

Modifications of Nordsieck's scheme for numerically integrating differential equations are described, which permit satisfactory operation in floating-point arithmetic. The major modification, recommended for both fixed-point and floating-point operation, is a reformulation of the test for numerical

stability. Also discussed, in relation to the floating-point scheme, is Nordsieck's use of guard digits and novel rounding techniques. A computer subroutine for the modified scheme is presented in the FORTRAN-II and FORTRAN-IV languages. Author (NSA)

N66-22166*# State Univ. of Iowa, Iowa City.
DERIVATION OF MAPPING FUNCTIONS FOR STAR-SHAPED REGIONS
Kwan Rim and Roger O. Stafford Washington, NASA, Mar. 1965 68 p refs Includes supplement and errata
(Grant NsG-576)
(NASA-CR-192) CFSTI: HC $2.00/MF $0.75 CSCL 12A

This report presents a simple method of deriving approximate mapping functions in the form of low order polynomials, which conformally map an annular region onto one whose inner and outer boundaries are star shaped and circular. The derivation is based on the Schwarz-Christoffel transformation. Illustrations are carried out in detail for a number of typical star-shaped regions. Some of the final results are presented by graphs, from which one may readily derive a particular polynomial for the approximate mapping of a certain class of star-shaped regions. Author

N66-22358*# State Univ. of Iowa, Iowa City.
DERIVATION OF MAPPING FUNCTIONS FOR STAR-SHAPED REGIONS
Kwan Rim and Roger O. Stafford Washington, NASA, Apr. 1966 29 p Suppl. to NASA-CR-192; see N66-22166
(Grant NsG-576)
(NASA-CR-192(01); NASA-CR-192) CFSTI: HC $0.75/MF $0.50 CSCL 12A

This report presents an extension of the method derived in NASA CR-192 to the problem of interior-to-interior mapping by the Schwarz-Christoffel transformation. The information presented herein is restricted to the same class of star-shaped regions analyzed in NASA CR-192, although the method of analysis can be readily extended to problems with any polygonal boundary. This supplement and its original report, NASA CR-192, constitute a complete report on the derivation of mapping functions for a large class of star-shaped regions by means of the Schwarz-Christoffel transformation. Author

N66-22373*# Colorado State Univ., Fort Collins.
AN OPTIMAL PROPERTY OF SEQUENTIAL DECISION PROCEDURES RELATED TO BAYES SOLUTIONS
Kenzo Seo Washington, NASA, Apr. 1966 6 p
(Grant NsG-569)
(NASA-CR-436) CFSTI: HC $0.10/MF $0.50 CSCL 12 A

An optimal property of a sequential probability ratio test was defined for sequential decision procedures for testing k statistical hyoptheses. Its connection with Bayes solutions was also investigated. The parameters of the problem are discussed, and two theorems which support the mathematical considerations are analyzed. H.S.W.

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N66-21167# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
APPLICATION OF WEATHER RADAR TO INTENSITY OF SURFACE PRECIPITATION Final Report, 1 Sep. 1963-31 Aug. 1965
Pauline M. Austin 31 Oct. 1965 51 p refs
(Contract DA-36-039-AMC-02225(E))
(AD-625964) CFSTI: HC $3.00/MF $0.50

The purpose of the research under this contract is to investigate the accuracy with which measurements of precipitation may be made by radar and to develop instrumentation and techniques for improving such measurements. There are four aspects to the work: instrumentation, observations, data processing, and analysis and applications. The project has been operating three radars: an AN/CPS-9, an SCR-615-B, and a 3.2 cm experimental radar. Auxiliary equipment for the radars includes two delay-line sweep integrators. Work has continued on a data processor which is designed to reduce radar data to digital form. An experimental model was built of a device to count and size raindrops by measuring the terminal fall velocities as they fall through a fixed vertical interval. Routine radar operations sampled the volume of atmosphere just above the recording rain gauges; drop size samples were obtained. Reduction of radar data to digital maps is being made and machine computations are made of the distribution and amounts of precipitation. From these two types of data the meso-scale characteristics of the precipitation are being deduced and are being compared with the large scale synoptic patterns. An analysis has been made of the problems encountered in measuring precipitation by radar, and is presented in Research Report No. 36. Author (TAB)

N66-21171# McGill Univ., Montreal (Quebec). Stormy Weather Group.
WEATHER RADAR MAPS ON FACSIMILE AND NEW THEORETICAL STUDIES Final Report, Jan. 1963-Aug. 1965
J. S. Marshall Oct. 1965 14 p refs
(Contract AF 19(628)-2489)
(AFCRL-65-846; AD-625889) CFSTI: HC $1.00/MF $0.50

This Final Report covers the period January 1963 to August 1965. It reviews the development in incorporation of facsimile reproduction and transmission of stepped grey scale weather radar maps into the McGill Weather Radar system. Theoretical studies in the reporting period found no reason for clouds to yield a smaller signal than that indicated by 'precipitation' theory. Author (TAB)

N66-21175# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
SURVEY OF LITERATURE ON METEORLOGY AND CLIMATOLOGY [LITERATUUROVERYICHT METEOROLOGIE KLIMATOLOGIE]
16 Feb. 1966 30 p refs In DUTCH, ENGLISH, and GERMAN
Its Vol. 12, No. M-135
CFSTI: HC $2.00/MF $0.50

Contains abstracts and bibliographic notes on perception methods and instruments, prediction techniques, composition and structure of the atmosphere, mechanics and thermodynamics, types of weather disturbances, radiation and temperature, atmospheric pressure, horizontal and vertical air currents, and condensation and precipitation. Transl. by J.O

N66-21295# Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Meteorological Support Div.

NIKE-APACHE SPEEDBALL II, ROUND NO. 77, SN 31 (14 OCTOBER 1965) Meteorological Data Report

Len E. Carter Dec. 1965 24 p

(ERDA-361; AD-475476)

Meteorological data gathered for the launching of NIKE-APACHE Speedball II, Round No. 77, SN 31, are presented for the Physical Sciences Laboratory, New Mexico State University of the U. S. Naval Research Laboratory, and for future ballistic studies. The meteorological data and resulting ballistic data appear in tabular form. Author (TAB)

N66-21453# Meteorology Research, Inc., Altadena, Calif.

ANALYSIS OF FLAGSTAFF DATA Second Quarterly Report, Feb. 1-Apr. 30, 1965

Paul B. Mac Cready, Jr., Alan I. Weinstein, and Donald M. Takeuchi [1965] 91 p refs

(Contract DA-28-043-AMC-0046(E))

(Rept.-2; AD-627147) CFSTI: HC $3.00/MF $0.75

This report continues the analysis of data obtained in the summers of 1962 and 1963 on the Flagstaff field program. The total program consists of four subjects: (1) precipitation mechanisms and droplet coalescence; (2) case studies of seeded clouds; (3) cloud and storm development; and (4) electrification. This report contains the final results of item (1) and a final portion of item (3), each given here as a separate portion with its own abstract. (1) The evolution of droplet distributions with height is given. Droplet concentrations were large, and some correlation of concentration versus upcurrent strength at cloud base was observed. Liquid drops grew in the cells by coalescence, perhaps starting from giant nuclei (often about 20 per liter, but zero in one case). Graupel from freezing and riming of these drops was regularly encountered at −5 and −6° C, mostly in the cloud outside the convective cores. (3) In southwest flow conditions, morning convective clouds form near the peaks primarily over the sunlit (eastern) slopes. Convective storm formation areas were (a) downwind of the peaks (the convective wake), (b) over the peaks (elevated heat source of the peaks), (c) over a low ridge southwest of Flagstaff (ridge heating), and (d) over the desert northwest of the peaks (isolated desert heat source). Author (TAB)

N66-21519# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).

DEVELOPMENT OF A METHOD FOR METEOR TRAJECTORY ANALYSIS Final Scientific Report

L. Moulin and J. Develay Nov. 1965 41 p refs

(Grant AF-EOAR-65-12)

(AFOSR-65-2940; AD-627695) CFSTI: HC $2.00/MF $0.50

It can be concluded from the present analysis that a method has been developed to calculate the geometry of natural meteors entering the atmosphere, and to deduce actual values of heat transfer coefficients and luminous efficiency factors, starting from observations of velocity, altitude and luminosity for various epochs. Systematic application of the method to a series of meteor data should lead to the formulation of correlations for heat transfer coefficients and luminous efficiency factors. From the particular case of meteor Meanook 132 it already appears that the drag coefficient plays a predominant role at high altidues and high velocities, that heat transfer is considerably larger than anticipated and that the luminous efficiency factor may not be regarded as constant but increases as the body penetrates the atmosphere. Author (TAB)

N66-21565# Weather Bureau, Washington, D. C. Air Resources Lab.

DISPERSION ESTIMATES FROM POLLUTANT RELEASES OF A FEW SECONDS TO 8 HOURS IN DURATION Technical Note No. 2

David H. Slade Aug. 1965 31 p refs

(ARL-1)

A simple method, based on on-site measurements made with a single wind system, is presented for estimating dosage or concentration values from point sources of pollution. The method is usable at any location situated in reasonably regular terrain, and is based on both diffusion theory and experimental evidence. Instructions for obtaining the required meteorological measurements are given. Dispersion estimates from pollutant releases are presented for sampling times (1) from 10 minutes to eight hours from continuous point sources and (2) from a few to 30 seconds from quasi-instantaneous point sources. M.W.R.

N66-21640# Texas A&M Univ., College Station. Dept. of Oceanography and Meteorology.

MESOSCALE CIRCULATIONS OF THE ATMOSPHERIC BOUNDARY LAYER, PART II Final Report

Kenneth C. Brundidge Jan. 1965 230 p refs

(Contract AF 19(604)-7455)

(AFCRL-65-63(II); AD-611313) CFSTI: HC $6.00/MF $1.25

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3. EDDY CONDUCTIVITY IN AND NEAR DRY COLD FRONTS IN THE LAYER, 70 TO 1270 FEET E. F. Conlan 49 p refs (See N66-21643 11-20)

N66-21641 Texas A&M Univ., College Station.

AN INVESTIGATION OF THE VERTICAL AND TEMPORAL DISTRIBUTIONS OF THE EDDY HEAT-DIFFUSION COEFFICIENT NEAR THE EARTH'S SURFACE UNDER FAIR-WEATHER CONDITIONS

Eugene You June Wong (M.S. Thesis) *In its* Mesoscale Circulations of the Atmospheric Boundary Layer, Pt. II Jan. 1965 105 p refs (See N66-21640 11-20) CFSTI: HC $6.00/MF $1.25

A numerical scheme was devised to solve the Taylor heat-diffusion equation for values of the eddy heat-diffusion coefficient, K, using a recursion relationship coupled with a forward-difference technique. It was found that the computed values of K fall in the approximate range of 10³ to 10⁶ cm^2sec^{-1}. The diurnal range of K is between half an order to two orders of magnitude. In general, the diurnal "wave" of K is discernible but has large fluctuations. The vertical distribution of K cannot be described by a single functional form; however, in many instances the lower portions of the K-vs-Z curves show a power relationship similar to that proposed by other investigators. Based on dimensional analysis, a power relationship is found between a quantity K*, which involves the wind-shear and the potential temperature gradient, and W*, which involves the height, windshear, and the acceleration of gravity. Averaged values of K for the winter as well as spring cases show that there is a seasonal

change of K. The spring nighttime values are about half an order of magnitude larger than the winter values. Author

N66-21642 Texas A&M Univ., College Station.
EVALUATION OF HEAT TRANSFER PROCESSES IN THE LOWER 1420 FEET OF DRY COLD FRONTAL ZONES
Bill Chatten Ryan (M.S. Thesis) *In its* Mesoscale Circulations of the Atmospheric Boundary Layer, Pt. II Jan. 1965 65 p refs (See N66-21640 11-20) CFSTI: HC $6.00/MF $1.25

Data from the 1434-ft Cedar Hill tower near Dallas, Texas are used to determine magnitudes of the coefficient of eddy conductivity and to evaluate associated energy transfer processes in and near cold frontal zones. Fields of values of eddy conductivity, heat flux convergence, relative heat advection, and the heat energy from the conversion of mechanical energy by friction are computed for time-vertical cross sections through three frontal zones. Values of eddy conductivity are found to be highly variable, and negative values are indicated in some regions by the technique that was utilized. A similarity of pattern of values of eddy conductivity is noticed in the three cases investigated. Author

N66-21643 Texas A&M Univ., College Station.
EDDY CONDUCTIVITY IN AND NEAR DRY COLD FRONTS IN THE LAYER, 70 TO 1270 FEET
Edward Francis Conlan (M.S. Thesis) *In its* Mesoscale Circulations of the Atmospheric Boundary Layer, Pt. II Jan. 1965 49 p refs (See N66-21640 11-20) CFSTI: HC $6.00/MF $1.25

Magnitudes and distributions of the coefficient of eddy conductivity are determined for three dry cold frontal regions. The eddy conductivity is computed from values of the lapse rate of potential temperature, the vertical variation of the lapse rate, mechanical friction, and relative advection in the frontal zone. The results show that the positive values of eddy conductivity range from 1.044×10^1 to 8.080×10^4 cm^2 sec^{-1}. A common pattern in the distribution can be identified in some regions of the cold frontal systems. Due to assumptions required to develop a computational technique, negative values of eddy conductivity are calculated for some regions of the frontal systems. Author

N66-21657*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
SENSING OF METEOROLOGICAL VARIABLES BY LASER PROBE TECHNIQUES Semiannual Report, 1 Aug. 1965–31 Jan. 1966
G. Fiocco 1 Feb. 1966 7 p refs
(Grant NGR-22-009-131)
(NASA-CR-71397) CFSTI: HC $1.00/MF $0.50 CSCL 04B

Optical radar investigations of the aerosol layer at 20 km have continued and noctilucent cloud observations were analyzed in connection with a study dealing with the sensing of meteorological variables by laser probe techniques. Work is underway on the development of a Doppler optical radar, and an experiment is proposed to measure Raman scattering of ruby light in the atmosphere. M.W.R.

N66-21706# Miami Univ., Coral Gables, Fla. Radar Meteorological Lab.
PROCEEDINGS OF THE 1965 ARMY CONFERENCE ON TROPICAL METEOROLOGY
Homer W. Hiser and Harold P. Gerrish, ed. Dec. 1965 271 p refs Conf. held in Miami Beach, Fla. 6–7 May 1965 *Its* Rept.-9
(Contract DA-28-043-AMC-00443(E))
(ML-65372; AD-627355)

Conference papers on local, small scale meteorological phenomena and problems, specifically excluding hurricanes and typhoons, are presented. For individual titles see N66-21707–N66-21725.

N66-21708 Colorado State Univ., Fort Collins.
WARM CORE CYCLONES DURING THE SOUTHEAST ASIA SUMMER MONSOON
Herbert Riehl *In* Miami Univ. Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 14–44 refs (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50

The following synoptic weather disturbances were ascribed as the major causes of precipitation: (1) cyclones that are well established at the ground and in the low troposphere, thin decrease upward (assumed warm core); (2) cyclones that are well pronounced in the middle troposphere and weak or nonexistent at low levels (assumed cold core); and (3) equatorial shearlines without definite center lying across all or most of Southeast Asia. Insofar as upper air data were insufficient, mean fields of the disturbances were constructed. Based on these constructions some results are given for warm core cyclones. An individual case is presented relating precipitation from hourly gages, satellite radiation data, and streamflow of the Mekong river. It is pointed out that this analysis shows the pattern to be followed for other cases where enough information is available. A thermodynamic analysis of inflow and outflow was completed, leading to determination of the required surface heat sources; and based on this analysis, precipitation was computed for the mean storm, and comparisons were made with precipitation determined from hourly readings. D.T.

N66-21709 Weather Bureau, Washington, D. C.
NEW INTER-OCEANIC CANAL FEASIBILITY STUDY–METEOROLOGICAL PROGRAM
Robert J. List *In* Miami Univ. Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 45–51 ref (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50

Plans to investigate the feasibility of constructing a sea-level inter-oceanic canal, including the possibility of using nuclear excavation techniques, call for the establishment of a two-year data collection program in eastern Panama and northern Colombia. An extensive meteorological program including radar wind stations, weather surveillance radar, synoptic surface observations, wind towers, rain gages and tetroon-tracking is planned. Author

N66-21710 Miami Univ., Coral Gables, Fla. Radar Meteorological Lab.
A SURVEY OF EXTREMELY HEAVY AND PROLONGED PERIODS OF HOURLY RAINFALL, TORNADOES, FUNNEL CLOUDS, WATERSPOUTS AND HAIL IN SOUTHERN FLORIDA
Harold P. Gerrish *In its* Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 52–61 (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50
(Contract DA-36-039-SC-89111)

Twenty-one years of weather observations are used to describe the climatology of extremely heavy hourly rainfall (≥2 inches), durations of hourly rainfall of moderate intensity or greater (6 or more continuous hours with no hour receiving <0.11 inches), tornadoes, funnel clouds over land, funnel clouds over water, waterspouts and hail in the South Florida

area, particularly in the vicinity of Miami. All of these phenomena occur mostly during the moist season, a period when the area is predominantly under tropical influences. Fifty-five case studies involving these phenomena during the months of June and September in the six-year period 1957–1962 are examined in detail in order to determine the type of weather features and the magnitude of meteorological parameters attending their occurrence. Preliminary three-dimensional synoptic models are also presented. Comments are made with reference to triggering mechanisms aloft. Author

N66-21711 Texas A&M Univ., College Station.
TROPICAL RAINFALL PATTERNS AND ASSOCIATED MESO-SCALE SYSTEMS
Walter K. Henry and John F. Griffiths *In* Miami Univ. Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 62–77 ref (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50

The month of October 1954 throughout the Pacific coast area of Panama and Costa Rica was very wet having in excess of 1800 mm of rainfall. This singularity is described and some suggestions offered as to the cause. The rainy and wet seasons are shown for a selection of stations in Central America. These illustrate the various patterns obtained. The maps of standard deviation of rainfall are discussed and the correlation between rainfall amount and standard deviation is obtained. A preliminary report on the use of harmonic analysis is also included. Author

N66-21712 Texas A&M Univ., College Station.
THE RELATION OF SUBTROPICAL HIGH MOVEMENTS TO RAINFALL IN THE AMERICAN TROPICS
Glen Cobb *In* Miami Univ. Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 78–88 refs (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50

Eastward movement of the North Atlantic subtropical high pressure cell allows a southerly air flow from the Pacific Ocean to move over Central America and the Caribbean. Subsequent re-positioning of the subtropical high, with attendant shear zones and confluence of air streams from the Atlantic and Pacific, is related to the occurrence and distribution of rainfall. Author

N66-21713 Servicio Meteorologico Nacional de el Salvador, San Salvador.
RAINFALL MESO-SCALE PATTERNS IN EL SALVADOR, CENTRAL AMERICA
Helmut Lessmann *In* Miami Univ. Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 89–95 refs (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50

Rainfall meso-scale patterns are shown by automatic rainfall records and rain gauge data. Productiveness, extension and other features of showers are discussed. The problematic behavior concerning its motion and orographic effects on tropical showers are outlined. Author

N66-21714 Florida State Univ., Tallahassee.
SOME CLIMATIC AND SYNOPTIC INFLUENCES ON DIURNAL VARIATION OF RAINFALL ON THE WINDWARD ISLANDS
N. E. La Seur *In* Miami Univ. Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 96–106 refs (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50

A total of 183 daily rainfall stations on six islands of the Windward group in the Caribbean is used to obtain frequency distributions of occurrence and amount of rain over a five year period. These frequency distributions are then used as a basis for a five point classification of the synoptic situation. This arbitrary classification is used to stratify the rainfall data for a five year period from self-recording gauges on Barbados. Before sorting no significant cycles can be detected in the twenty-four hour records. After sorting according to this classification, clear-cut diurnal and semi-diurnal variations in the daily rainfall are revealed. The role of synoptic scale disturbances is illustrated and the necessity to order data in some appropriate way before subjecting it to statistical analysis is emphasized. Author

N66-21715 Raven Industries, Inc., Sioux Falls, S. Dak.
THE HAILSTORMS OF LOW LATITUDES
E. M. Frisby *In* Miami Univ. Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 107–122 refs (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50
(Contract DA-49-092-ARO-18)

Between the latitudes 25°N and 55°N in North America several climatically different hail areas were identified. These are: the northern Plains areas, which provide examples of swath type hail damage, the result of large travelling storm activity; the southern States, which provide examples of swath and sporadic type hail damage, the result of travelling storm and single cell cumulo-nimbus development; and the southwest mountain areas, which provide examples of sporadic convection aided by topography. A comparison was made to show how tropical hailstorms differ in size and type from those occurring between the forenamed latitudes. D.T.

N66-21716 Florida State Univ., Tallahassee.
DIURNAL AND SEMI-DIURNAL VARIATIONS OF SENSIBLE AND LATENT HEAT EXCHANGE, CLOUDINESS AND PRECIPITATION OVER THE WESTERN TROPICAL ATLANTIC
Michael Garstang *In* Miami Univ. Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 123–136 refs (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50

Twenty-three days of data were collected at a fixed ocean station east of Barbados during 1963. These data are combined with a similar set gathered in 1957 to investigate diurnal and semi-diurnal variations over the open tropical oceans. A marked diurnal variation in sensible heat transfer is obtained but a less defined diurnal change is found in latent heat transfer. These results indicate that the spatial distributions of sensible heat transfer obtained by previous workers are likely to be in error. A distinct semi-diurnal variation in cloudiness and precipitation is obtained for this open ocean station. Consistency in results of the two observing periods as well as consistency of various measurements leaves no doubt about the existence of such regular cycles of cloudiness and precipitation over the open ocean. The relationships between these cycles and the diurnal variation in heat transfer is not yet clear. At least two other mechanisms must be considered, namely radiation and the atmospheric tide. Author

N66-21717 National Engineering Science Co., Houston, Tex.
RAINFALL FREQUENCY OF THE AREA 0–30°N, 50–100°W
W. H. Portig *In* Miami Univ. Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 137–147 ref (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50

A climatological study of the water area which separates the isolated areas of Middle America is begun using precipitation reports by ships. Although the number and quality of the data leave much to be desired, a number of the resulting patterns of rainfall frequency are interpreted and some temporal and spatial variations are discussed. The equatorial rainfall belt is found to move less than it was believed. Author

N66-21718 National Engineering Science Co., Houston, Tex.

A SYSTEM OF TWO-DIMENSIONAL MESOSCALE ANALYSIS AND FORECASTING WITH FRICTION AND MOISTURE

John C. Freeman, Jr. and Joseph L. Goldman *In* Miami Univ. Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 148–161 (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50

The effects of friction and moisture are added to a two-dimensional model of tropical flow associated with the trade-wind inversion under balanced and unbalanced conditions. A model containing some of the recently found characteristics of waves in the trade-wind inversion is developed and a simplified approach to the dynamic solution of the problem of motion of this wave is presented. Author

N66-21719 Technische Hochschule, Karlsruhe (West Germany). Meteorologisches Institut.

STRUCTURE OF RAIN IN ENTEBBE, CENTRAL AFRICA

Max Diem *In* Miami Univ. Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 162–180 (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50

Single measurements were taken of precipitation in Entebbe, central Africa, in order to determine the mean drop diameter, mean spectrum width, precipitation intensity, drop number, and water content, and to establish a correlation between these quantities for an ideal rain model in which the drop size is equal to the spectrum width. Results show a well defined association between the drop diameter and spectrum widths on one hand, and water content and precipitation intensity on the other. Calculations were also carried out to determine radar reflectibility as a function of spectrum width. D.T.

N66-21720 Travelers Research Center, Inc., Hartford, Conn.

KINEMATICS AND DYNAMICS OF TROPICAL PRECIPITATION

G. Arnason and E. A. Newburg *In* Miami Univ. Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 181–189 refs (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50

The work reported deals with the first phase of a numerical experiment in moist cloud convection including the precipitation phase. It is confined to the special case of shallow dry convection of the roll-type and concerns the development in time of a buoyant bubble in neutral surroundings. The evolution of events studied span over 20 minutes beginning with a maximum temperature excess of 0.38°C over the neutral surroundings at 600 m above the ground and ending by the time the temperature maximum has been reduced to 0.13°C, and is approaching the upper boundary (3000 m). At an early stage, the bubble takes the shape of a mushroom cloud with a slim stem and a rounded top which is characterized by a concentration of isotherms. The associated circulation increases first quadratically with time, but later it becomes near lineear and shows deceleration at the end of the twenty minute period. Of particular interest is the pressure field that is induced by the buoyant bubble. It creates an inflow along the lower boundary and accelerates the inflowing air upwards along the stem of the rising bubble. In the upper part of the bubble, the pressure gradient acts against the buoyance force. Author

N66-21721 Weather Bureau, Miami, Fla. National Hurricane Research Lab.

SOME PRELIMINARY THEORETICAL CONSIDERATIONS OF TROPOSPHERIC WAVE MOTIONS IN EQUATORIAL LATITUDES

Stanley L. Rosenthal *In* Miami Univ. Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 190–224 refs (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50

Wave solutions to the linearized, quasi-hydrostatic equations for adiabatic, nonviscous flow on an equatorially oriented beta plane are obtained. The basic current is assumed to be zonal and invariant in both space and time. Only solutions for which the meridional-wind component is symmetric with respect to the equator are considered. Disturbances with wave lengths on the order of 10^8 m are found to be very nearly nondivergent which agrees with the results of Charney's scale analysis of low-latitude atmospheric motions. The solutions show the meridional-wind component to be very nearly geostrophic even at very low latitudes. The perturbation of the zonal wind, however, is highly ageostrophic at the very low latitudes and significantly ageostrophic even in subtropical latitudes. Author

N66-21723 Weather Bureau, Washington, D. C. Lab. of Climatology.

ESTIMATION OF PRECIPITATION PROBABILITIES

George W. Cry *In* Miami Univ. Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 233–244 refs (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50

The utility of the incomplete gamma distribution for fitting series of weekly, monthly, and seasonal precipitation totals is discussed. This model has highly desirable statistical properties and has been found to be a good approximation for these data. Author

N66-21724 National Weather Satellite Center, Washington, D. C.

AUTOMATIC PICTURE TRANSMISSION FROM SATELLITES

L. F. Hubert *In* Miami Univ. Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 245–253 (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50

It is pointed out that automatic picture transmission data can be used in making mesoscale interpretations of meteorological events in remote areas. Other suggested uses include: (1) the detection of an area of bad weather, and a forecast based upon the wind flow; (2) the determination of onshore–offshore wind regimes from cloud configurations; and (3) the determination of wind and temperature regimes in mountainous areas from cloud configurations. D.T.

N66-21725 Weather Bureau, Miami, Fla. National Hurricane Center.

DEVELOPMENT OF A TROPICAL ANALYSIS CENTER AT MIAMI

Gordon E. Dunn *In* Miami Univ. Proc. of the 1965 Army Conf. on Trop. Meteorology Dec. 1965 p 254–256 (See N66-21706 11-20) CFSTI: HC $6.00/MF $1.50

Progress is reported on the organization and development of a tropical meteorological data center. Analyses were carried out daily at the surface, and at 700 and 200 millibars

for the area from 130°W to 40°E, and from 40°N to 35°S. Data was received from South America and from Tiros IX. Plans are also reported for a high altitude circuit covering the area analyses are to be carried out for surface data and at 700 and 500 millibars. D.T.

N66-21753# Holman (John F.) and Co., Inc., Washington, D. C.

EFFECT OF METEOROLOGICAL FACTORS DURING RADAR MEASUREMENTS [KUCHETU VLIYANIYA METEOROLOGICHESKIKH FAKTOROV PRI RADIODAL'NOMERNYKH IZMERENIYAKH]

O. A. Mozzhukhin Ft. Belvoir, Va., Army Engr. Res. and Develop. Labs., Feb. 1966 8 p ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Geod. i Aerofotos. (Moscow), Issue 3, 1964 p 27-31

(Contract DA-44-009-AMC-930(T))

(ERDL-T-1818-65; AD-627538) CFSTI: HC $1.00/MF $0.50

The basic source of errors in high frequency radar measurements due to meteorological factors is identification of the refraction index n_{av} obtained as the average value of measurements made at the end of the line with its true value n, which is characteristic for the entire measured line at the level of radio beam transmission. The error depends first on the value of the vertical gradient of the refraction index within the layer of atmosphere where the radio waves are propagated during radio geodetic measurements. If the law is known for the variation in the refraction index with altitude and the average height of radio beam h over the base surface (for example, by taking measurements from a topographical chart); an attempt can be made to reduce the index of refraction measured close to the surface of the Earth to the altitude h and thereby to correct the measured radar distance. To clarify the question of variation in the refraction index with altitude, experimental data on the temperature and humidity of air at four altitudes in a layer extending to 106 m over an open, level region were processed. TAB

N66-21754# Aracon Geophysics Co., Concord, Mass.

METEOROLOGICAL SATELLITE TECHNIQUES FOR THE ARMY Second Quarterly Report, 1 Aug.-31 Oct. 1965

P. E. Sherr, R. J. Boucher, W. K. Widger, Jr., C. W. C. Rogers, and J. C. Barnes Nov. 1965 44 p refs *Its* Rept.-9G21-7

(Contract DA-28-043-AMC-01273(E))

(ECOM-02173-2; AD-627442) CFSTI: HC $2.00/MF $0.50

The research reported herein was conducted during the second quarter of a contractual investigation aimed at providing the Army field units with techniques for the use of weather satellite data. Results to date for each of several tasks are discussed. These include: (1) Mesoscale analysis and interpretation studies; (2) Analysis of Army requirements for applications of weather satellite data; (3) Case studies of World War II, Korean or U. S. Field maneuver synoptic situations, using analogs for which satellite data are available; (4) Investigations of methods for determining weather affecting enemy operations; (5) Procedures for field use of meteorological satellite data; and (6) Operational guide preparation. Examples of the types of analyses being prepared for the tasks concerned with mesoscale studies, case studies, and weather affecting enemy operations are presented and discussed. A rather complete description of the applicability of satellite data to Army meteorological requirements is presented and outlines the capabilities of the satellite to observe various meteorological parameters such as, wind, temperature, and visibility. Author (TAB)

N66-21797# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

SWAMI: STANFORD WORLDWIDE ACQUISITION OF METEOROLOGICAL INFORMATION. AN ANALYSIS AND PRELIMINARY DESIGN STUDY FOR A GLOBAL METEOROLOGICAL DATA COLLECTION SYSTEM

Lee R. Talbert, ed. Jun. 1964 411 p refs

(SUDAER-213)

Details are given on a project conducted to give graduate students experience in the preliminary analysis and design of a complex new engineering system. The specific subject was an automatic, global, weather data collection system. Technical areas of special interest were considered to be: the position determination of balloons and buoys by range measurements on the satellite; the use of an on-board microdigital computer; and the choice of an optimal orbit configuration. It was concluded that a fully operational system by 1970 would consist of the following: three satellites in 1200 nautical mile, circular, polar orbits; a microelectronic, general purpose, digital computer on board each satellite for interrogation of remote stations, storage of sensor data, and readout to a central ground facility; and global network of 3200 free floating, super-pressure baloons at 18,000 and 50,000 feet, a network of 1200 free floating ocean buoys, and 600 land-based stations. N.E.N.

N66-22200*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE INTERPRETATION OF TIROS RADIATION DATA FOR PRACTICAL USE IN SYNOPTIC WEATHER ANALYSIS

Lewis J. Allison and Guenter Warnecke [1965] 49 p refs Submitted for Publication

(NASA-TM-X-56514) CFSTI: HC $2.00/MF $0.50 CSCL 04B

Radiation data in the 8-12 micron atmospheric window and 6-6.5 micron water vapor absorption region acquired from the TIROS III meteorological satellite on 16 July 1961 are used to demonstrate some of the practical applications of satellite radiation data in synoptic weather analysis, looking to the near-future when similar data will become available for operational use. These applications include the mapping of horizontal cloud patterns at three different scales from meso- to quasi-global, the derivation of mean relative humidities in the troposphere over the United States, and the inference of vertical cloud structure along a cross section extending from Jamaica to British Columbia. Each of the applications is discussed in the light of the corresponding conventional surface, upper air, vertical motion, relative humidity, precipitation, and cloud cover charts. Also, satellite television pictures are used in the discussion of meso- and macro-scale cloud mapping. Author

N66-22212*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.

SATELLITE METEOROLOGY

S. I. Rasool [1965] 16 p refs Submitted for Publication

(NASA-TM-X-56624) CFSTI: HC $1.00/MF $0.50 CSCL 04B

A discussion of data obtained from cloud cover photographs, infrared radiation measurements, and other types of measurements detected by television cameras and equipment aboard Tiros and Nimbus weather satellites is presented. The view of the earth from space shows that about 50% of the global surface is usually covered with clouds. The uses of the cloud information obtained, with respect to meteorology and navigation are discussed. The effects of solar radiation on the changes occurring in the atmosphere, and the measurement of ultraviolet radiation as a means of deducing the distribution of ozone in the atmosphere are also discussed. L.S.

N66-22304*# National Aeronautics and Space Administration, Washington, D. C.
RADAR CHARACTERISTICS OF STORM CLOUDS [OSOBENNOSTI RADIOLOKATSIONNYKH KHARAKTERISTIK GROZOVYKH OBLAKOV]
S. B. Gashina and Ye. M. Sal'man Feb. 1966 17 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 173, 1965 p 19–25
(NASA-TT-F-10014) CFSTI: HC $1.00/MF $0.50 CSCL 04B

One of the basic problems of storm forecasting by radar is to localize regions of intense storm activity against the background of the general field of cumulo-nimbus clouds. The present study searched for further reliable radar storm-cloud criteria which would take into account the cloud dynamics affecting the radar echoes. The paper describes the experimental method utilizing a ground and aircraft laboratory, the vertical structure of convection clouds, and radar echo areas of convection clouds. Tests showed that storm clouds representing the final stages of development of convection clouds (a) reflect signals whose vertical reflectivity is only weakly dependent on altitude; (b) exhibit stronger reflectivity from the super-cooled layer of the cloud only; furthermore, the maximum height of radio echo propagation is twice the height of the zero level isotherm; (c) the horizontal dimensions of the radar echo are larger than the vertical dimension; and (d) the total reflectivity of the cloud volume V. Author

N66-22385# Texas A&M Univ., College Station. Dept. of Meteorology.
RESEARCH ON TROPICAL RAINFALL PATTERNS AND ASSOCIATED MESO-SCALE SYSTEMS Tenth Quarterly Progress Report, 1 Aug.–31 Dec. 1965
Walter K. Henry, John F. Griffiths, L. Glen Cobb, John S. Cornett, and Tommy D. Guest 4 Jan. 1966 162 p refs
(Contract DA-36-039-SC-89202)
(Rept.-10; AD-628768) CFSTI: HC $15.80/MF $1.00

The contingency index is used as a tool to show the differences of rainfall and the terrain in Costa Rica. The differences, even with small orographic influences, can be noted. The unusually heavy rain occurring in Panama during 1935 is identified as to period and region. Standard mathematical analytical procedures show that some regions received amounts which may be classified as one in a thousand or one in ten thousand probabilities. The synoptic data pertinent to this period are, unfortunately, not available. The seasonal distribution of precipitation in Honduras is illustrated by means of percentage changes in the monthly rainfall. The general inference from these maps is that changes begin in the south of the country but a few months are characterized by disturbances originating in the north. The daily rainfall observations from San Salvador, El Salvador are examined for independence to determine if they may be approximated by a Markov chain probability model. A tabulation of the marginal and conditional probabilities based on a first order Markov chain are presented and examples are given showing how the probability of occurrence for any sequence of wet and/or dry days may be calculated. Author (TAB)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N66-21647*# Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Control Lab.
BENDING MODE ACCELERATION INFLUENCE ON PILOT CONTROL OF FLEXIBLE BOOSTER DYNAMICS
Philip S. Kilpatrick II (M.S. Thesis) Sep. 1965 113 p refs (Grant NsG-577)
(NASA-CR-71389; T-65-2) CFSTI: HC $4.00/MF $0.75 CSCL 22C

This investigation is concerned with the general problem of man's ability to directly control a large flexible launch vehicle. Specifically, the effect of a flexible body mode on pilot control of simulated single axis Saturn V rigid body dynamics is studied. First bending mode amplitude and natural frequency, and the type of simulation, fixed or moving base, are the variables considered most intensively. Brief studies of variations in the RMS level of the disturbance signal and comparisons of two proposed control stick filters and vehicle augmentation schemes are included. The effects of the flexible mode on the pilot and his closed loop performance are analyzed by ratios of attitude error to disturbance signal and control stick output to attitude error, and by computed pilot transfer functions. Author

N66-21697*# TRW Systems, Redondo Beach, Calif.
NAVIGATION EXPERIMENT UTILIZING RELAY II SATELLITE
Washington, NASA, Apr. 1966 28 p
(Contract NAS5-9503)
(NASA-CR-429) CFSTI: HC $0.40/MF $0.50 CSCL 17G

Ranging measurements are reported from two different Relay II satellite passes over a target in a navigational experiment. The problem to utilize ranging data and orbital parameters for accurate localizations was first evaluated theoretically by error analysis, and the actual data were then compared with theoretical errors. It was concluded that an accurate station keeping system has to use range, azimuth, and elevation data in addition to an exact knowledge of the satellite orbit used. G.G.

N66-21701*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
LINEAR THEORY OF IMPULSIVE VELOCITY CORRECTIONS FOR SPACE MISSION GUIDANCE
Luigi S. Cicolani Washington, NASA, Apr. 1966 46 p refs (NASA-TN-D-3365) CFSTI: HC $0.65/MF $0.50 CSCL 17G

One aspect of midcourse guidance is the determination of the guidance correction, usually specified by an equation that gives the required velocity change as a function of the current state of the vehicle. With the assumptions that impulsive velocity corrections are made and that the equations of motion can be linearized about a reference orbit, the required midcourse velocity correction will be a linear function of the deviation of the vehicle state from the reference state. Such linear guidance equations form a particularly simple class which is analyzed in this paper from the viewpoints of linear vector spaces and the theory of linear equations. Existence conditions and two formulations of the guidance equation from the mission constraints are given. Properties of form and time-invariant properties of the guidance equations and relations among the basic notions of the theory are also discussed. Finally, a number of examples from the recent literature are examined. Author

N66-21798# Institute for Defense Analyses, Arlington, Va. Economic and Political Studies Div.
THE NORTH ATLANTIC AIR-TRAFFIC CONTROL SYSTEM: ECONOMIC ANALYSIS OF PROPOSED CHANGES
Final Report
Allen H. Skaggs, Norman J. Asher, Richard Halfyard, and Elizabeth Parker Sep. 1965 70 p refs
(Contract FA-65-WA-1069)
(IDA/HQ-65-3898; S-198; RD-65-95)

The study is a cost–benefit analysis to determine the economic impact of implementing certain FAA-specified technical changes to the North Atlantic air traffic control system. As such, it attempts to determine which system would afford the maximum benefit to the community of countries who provide and use the system. Accordingly, it recommends which among the technically feasible changes in facilities, services, and procedures are economically justified. Two basic types of changes have been proposed: additional ground equipment to increase the capacity of the transition areas, and reduction of separation criteria in the oceanic area. The study concludes that non-automated surveillance radar coverage should be extended over the entire transition area.
Author

N66-22213*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SIMULATION STUDIES OF SST TERMINAL AREA NAVIGATION IN THE ATC SYSTEM
Richard H. Sawyer, Michael C. Fischer, and Joseph P. O'Brien (FAA, Washington) [1965] 30 p refs Presented at the 16th IATA Tech. Conf., Miami Beach, Fla., 22–30 Apr. 1965
(NASA-TM-X-56659) CFSTI: HC $2.00/MF $0.50 CSCL 17G

Simulated tests, designed to study the problems anticipated with introduction of the supersonic transport into the air traffic control system, were conducted. Initial tests consisted of simulated departure and arrival operations of a variable-sweep-SST configuration in the New York terminal area under high density traffic flow conditions with as many as six SST operations per hr. Photographs of the simulated air traffic control equipment are shown. Several types of separation standards and handling concepts were investigated. Graphic illustrations are given showing arrival and departure profiles and operating boundaries; transatlantic departure and arrival routes; ascent and descent heading changes; lead- and nonlead-type turns; transcontinental departure routes; scheduled and actual ascent profiles; and crew workload during both ascent and descent.
L.S.

N66-22238*# National Aeronautics and Space Administration, Washington, D. C.
CONTROL AND GUIDANCE RESEARCH AT NASA
Charles H. Gould [1965] 15 p refs Presented at the Intern. Meeting on Automatic Control in the Peaceful Uses of Space, Stavanger, Norway, Jun. 1965
(NASA-TM-X-56679) CFSTI: HC $1.00/MF $0.50 CSCL 17G

A program of advanced control and guidance research is underway within the National Aeronautics and Space Administration to develop the control and guidance technology required for future space and aeronautical missions. The research objectives are reviewed, and by example, the nature of the efforts is shown.
Author

N66-22337* National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
CONCEPTS OF THE ITERATIVE GUIDANCE LAW FOR SATURN LAUNCH VEHICLES
Clyde D. Baker *In its* Aero-Astrodyn. Res. Rev. No. 3 15 Oct. 1965 p 56–64 refs (See N66-22329 11-34) CFSTI: HC $4.00/MF $1.00

An iterative guidance solution to the problem of injecting a spacecraft into a circular orbit about the earth is presented. The control, guidance, and navigation systems are treated separately. For the specific guidance problem discussed, it is assumed that the engines are cut off when the specified altitude is reached with zero degrees path angle and circular velocity. The basic concepts of the iterative guidance law are developed for the Saturn launch vehicles.
N.E.N.

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N66-21128# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Reaktorzentrum.
THE DETERMINATION OF THE CAPTURE CROSS-SECTION OF Gd^{156} FOR NEUTRON REACTORS [DIE BESTIMMUNG DES EINFANGQUERSCHNITTES VON Gd^{156} FUR REAKTORNEUTRONEN]
G. Lugmair and F. P. Viehbock 1965 14 p refs In GERMAN Submitted for Publication
(SGAE-PH-35/1965) CFSTI: HC $1.00/MF $0.50

Neutron capture cross section ability of isotopic gadolinium^{156} was studied by mass spectrometric analyses before and after exposure to a thermionic source. Through application of a 4.5 A heating current was an ionic gadolinium flow of 1.10−11 obtained; isotopic densities were then calculated for irradiated as well as normal gadolinium spectra by computer and the results are presented in tables.
Transl. by G.G.

N66-21150# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.
THE ACHIEVEMENT OF ECONOMIC NUCLEAR POWER IN THE U.K.
T. N. Marsham 1965 27 p
(TRG-1096-(R))

The progress of gas-cooled reactor development is surveyed, from Calder through the commercial magnox stations to the Advanced Gas-cooled Reactor selected for the Dungeness "B" power station. The scale of fuel production facilities to support economic nuclear power programs is discussed, and the role of fast reactors in conserving fuel supplies is indicated. Economic nuclear power can now be provided by large stations meeting base-load requirements. The station size at which nuclear power becomes economic depends on the cost and availability of alternative fuels, and the decision by any country as to whether to embark on an independent program of reactor development must be governed by the scale of the program.
Author

N66-21208# United Kingdom Atomic Energy Authority, Windscale (England).
AN INVESTIGATION OF THE INTERCHANGE OF IODINE SPECIES UNDER ADVANCED GAS-COOLED REACTOR CONDITIONS
J. J. Hillary and J. C. Taylor 1966 37 p refs
(TRG-954(W)) HMSO: 4s

Experiments were performed with tracer idodine-131 released into gas either held in a hot steel pressure vessel coated with an organic base primer or passed through a similarly coated steel pipe. The subsequent iodine content of the gas investigated. The results show that at 390° C in a CO_2-CO atmosphere in absence of air all the forms of iodine produced deposited rapidly, and the proportion found on particles depended on the presence of a source of aerosols. At lower temperatures deposition rates were reduced. Addition of air caused the release of some of the deposited iodine in the elemental form, which persisted as long as air remained. The rate of decomposition of methyl iodide in the absence of air was somewhat erratic, and appears to be very temperature dependent in the region 370–390° C. Long-term desorption studies show that iodine which continues to be released can vary in form under apparently similar conditions. When iodine desorbs into a gas stream in the range 20–300° C, from a pipe wall, the proportion of penetrating species (e.g. methyl iodide) formed increases with temperature. Author

N66-21236# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.
APPLICATIONS OF TWO-PHASE HEAT-TRANSFER DATA TO BOILING-WATER REACTOR DESIGN
R. H. Campbell 1966 13 p
(TRG-1154(R))

This Report was prepared as the basis for a lecture given to Two-phase Heat-transfer Course No. 4 at Harwell, to illustrate the way in which the heat-transfer information is used in reactor design. It considers the two stages of (a) initial design and optimisation, and (b) heat-transfer work carried out during the project stage. In the first, the main need is for a correlation which can be used to select the design. During the project stage, detailed aspects of the design are investigated to obtain maximum power from the channel consistent with low neutron absorption and low fuel fabrication costs. Author

N66-21305# Atomic Weapons Research Establishment, Aldermaston (England).
SWAN: A MULTI-GROUP ONE-DIMENSIONAL DIFFUSION CODE FOR THE IBM 7030
A. Brickstock and A. R. Davies Jan. 1966 51 p refs
(AWRE-O-99/65) HMSO: 7s

SWAN is a code for solving the multi-group diffusion equations in one dimension. Spherical, cylindrical or slab geometry is allowed, the last two requiring values of "buckling" to take account of leakage in directions transverse to the one being considered. Variable dimension arrays are used throughout so that the only restriction is on total problem size. A full downscatter matrix is allowed but may be truncated if desired. Data may be input in macroscopic form from cards, but the normal input is from one of a number of library tapes. The code is designed to take resonance self-shielding into account automatically and also to make approximate corrections for heterogeneity. Author

N66-21591# United Kingdom Atomic Energy Authority, Windscale (England).
REACTOR PHYSICS CALCULATIONS WITH THE ARGOSY CODE
J. G. Tyror 1965 31 p refs
(TRG-1014(W)) HMSO: 4s 6d

This report presents recommendations for using the ARGOSY code, for processing output from ARGOSY, and for the use of ARGOSY output data in reactor calculations. Author

N66-21602# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
BEAM TUBE EQUIPMENT FOR THE FRJ-2 (DIDO) COLD NEUTRON SOURCE
C. Doose Aug. 1965 30 p refs Transl. into ENGLISH from Kernforschungsanlage Julich Internal Report, 1965
(AERE-TRANS-1043) CFSTI: HC $2.00/MF $0.50

In order to utilize different moderator material than liquid hydrogen without requiring great structural alterations, the direct cooling of the moderator container with helium has been chosen. In this case the hydrogen is condensed in a separate moderator chamber. Operational conditions for the beam hole insertions have led to a design in which the vacuum jacket is cooled by D_2O. The cold parts are vacuum-insulated. In case the gas-cooling system is turned off, but the reactor is still in operation, the cooling of the moderator container is accomplished by heat transfer through a helium-annulus to the D_2O cooled vacuum jacket. A static helium barrier has been chosen for the safety-system which has considerable advantage over an explosion-proof tube. It is especially safe since the cause of explosions is thus removed. The discussion on some cases of interference points out that the beam hole insertions are independent of the low-temperature equipment. Only in case of failure of the D_2O-cooling circuit is the activation of the reactor safety system necessary. Author

N66-21662*# Massachusetts Inst. of Tech., Cambridge. Dept. of Nuclear Engineering.
CALCULATION OF THE DEEP PENETRATION OF RADIATION BY THE METHOD OF INVARIANT IMBEDDING
Donald Richard Mathews (Ph.D. Thesis) Feb. 1966 129 p refs
(Grant NsG-496)
(NASA-CR-71388) CFSTI: HC $4.00/MF $1.00 CSCL 18F

The method of invariant imbedding has been applied to energy dependent shielding problems with anisotropic cross sections. The method seems to offer advantages over competing methods when the shield is either very heterogeneous or heterogeneous and very thick. Plane geometry reflection and transmission equations are derived using the method of invariant imbedding and their numerical solution is discussed. A simple exponential approximation is shown to work well for the solution of these equations. Results for several problems, including thick water and thinner iron/polyethylene/iron shields, are given and compared with other methods. Author

N66-21727*# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.
IN-PILE MEASUREMENT OF UO_2 THERMAL CONDUCTIVITY Final Report
M. G. Balfour, J. A. Christensen, and H. M. Ferrari 1 Mar. 1966 57 p refs
(Contract NAS3-4589-PB)
(NASA-CR-54740; WCAP-2923) CFSTI: HC $3.00/MF $0.50 CSCL 18I

In-pile effects of stoichiometry and grain growth on UO_2 thermal conductivity were studied in instrumented fuel capsules. Results show that columnar grain growth has no significant effect on heat transfer in UO_2 fuels. Migration of lenticular voids during irradiation was shown to have an important effect on fission product redistribution. Irradiation of a $UO_{1.941}$ capsule showed a mean thermal conductivity nearly 20 percent higher than in a $UO_{2.005}$ capsule under similar conditions. Author

N66-21869# Library of Congress, Washington, D. C. Aerospace Technology Div.
FRENCH NUCLEAR REACTOR DEVELOPMENT Surveys of Western Open Literature
Anatol Surac 16 Dec. 1965 52 p refs
(ATD-P-65-115)

This comprehensive report is based on Western open sources published 1958–1965. Various aspects of French nuclear reactor development are reviewed. Special emphasis is placed on research and test reactors and topics related to advanced reactor technology. The relations between and the contributions of the various controlling agencies, professional associations, and industrial concerns in the nuclear field are discussed. A brief description is presented of French nuclear-reactor research centers and of reactors now in operation or under construction. The seven chapters are titled as follows: controlling agencies, industry, associations, research centers, experimental research and test reactors, fast reactors, advanced reactor development. The Appendix covers the following: CEA organization diagram, 1 January 1965; reactor index. There are 13 references listed at the end of the report; in addition, short references totaling 80 are also cited under the description of each individual reactor. Author

N66-21926# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
SAFETY ANALYSIS REPORT—SNAPTRAN 2/10A-1 AND SNAPTRAN 2/10A-2 SAFETY TESTS
W. J. Neal, ed. Oct. 1965 159 p refs
(Contract AT(10-1-205)
(IDO-17076) CFSTI: HC $5.00/MF $1.00

The results of safety analyses performed on the SNAPTRAN 2/10A-1 and SNAPTRAN 2/10A-2 reactors are presented. These reactors will be utilized to experimentally investigate the transient power behavior of a SNAP 10A/2 reactor in both the nondestructive and destructive region. Also included are descriptions of test program, the reactor test packages, and the test site facilities. Calculations are presented to indicate the analytical techniques used to determine the transient behavior of the reactor for various reactivity additions and to determine the radiation doses to be expected for various conditions. The calculations show that an unplanned destructive excursion with an energy release of 220 Mw-sec yields a maximum off-site dose of 6.3×10^{-2} rem to a child's thyroid due to inhalation of the released fission products. From the results of the analysis, it was concluded that the SNAPTRAN 2/10A-1 and SNAPTRAN 2/10A-2 test programs can be carried out without undue hazard to the general public. Author

N66-21940# Laboratoires du Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
IN PILE CORROSION OF NUCLEAR MATERIALS Final Report, Mar. 1962–31 Mar. 1964
[1964] 43 p
(Contract EURATOM-084-62-3 RDB)
(EUR-2674; EURAEC-1522) CFSTI: HC $2.00/MF $0.50

Corrosion experiments on aluminum, stainless steel, zirconium, titanium, niobium, zircaloy-2 and platinum were carried out in-pile and after pile irradiation, and the results were compared with those obtained out-of-pile under identical conditions. Two horizontal channels and one vertical channel of the BR1 reactor were used in which the thermal neutron flux was 1.38×10^{12} n/cm^2/sec and the fast neutron flux was 1.4×10^{12} n/cm^2/sec (2.8 Mev). The gamma flux during operation of the reactor was 7.3×10^5 R/hr for energies between 1 and 5 Mev. After shut-down the gamma flux was 2.6×10^5 R/hr for energies from 0.4 to 2.8Mev. Electrochemical techniques were applied as testing method. It was confirmed that passivation of aluminum is improved by pile irradiation, as indicated by decreased anodic currents and increased oxygen overvoltages. Potential-current curves on 18/8 chrome nickel steels showed that the anodic currents increased with irradiation when the solution was nitrogen, oxygen, or argon saturated and in all acidities. In-pile potential-current measurements on a ferritic steel (CSX) showed large anodic currents and current peaks. These electric currents indicated a strong general corrosion. The post irradiation examination of zirconium, Zicaloy-2, titanium, and niobium showed that the thickness of the initial oxide films on those metals increased with increasing irradiation dose. Gamma rays had a similar, but smaller effect as pile irradiation. It was concluded that the effects of pile irradiation on the corrosion process are mainly solution effects and not so much metal effects. However, the mechanism of the reactions is not well understood. (NSA)

N66-21945# California Univ., Berkeley. Lawrence Radiation Lab.
THE IMPACT OF SEMICONDUCTOR DETECTORS ON GAMMA-RAY AND ELECTRON SPECTROSCOPY
Jack M. Hollander 1 Aug. 1965 131 p refs Presented at the Intern. Meeting of Nucl. Instrumentation, Herceg-Novi, Yugoslavia, Aug. 1965
(Contract W-7405-ENG-48)
(UCRL-16307; CONF-650832-1) CFSTI: HC $4.00/MF $1.00

A review of the semiconductor impact on gamma spectroscopy is presented. In particular, the operating characteristics of Ge(Li) detectors are discussed along with its many uses. Examples of data taken with semiconductor detectors are presented for the following: decay scheme studies, measurement of pair production cross section near threshold, heavy-ion reactions, low temperature nuclear orientation, g-factors of nuclear excited states, observation of the effect of chemical state on the lifetime of a low-energy isomer, neutron activation analysis, and electron-gamma spectroscopy. (NSA)

N66-21958# Oak Ridge National Lab., Tenn.
PROPERTIES AND PROSPECTS OF THORIA-BASE NUCLEAR FUELS
A. R. Olsen, D. A. Douglas, Y. Hirose, J. L. Scott, and J. W. Ullmann [1965] 40 p refs Presented at the Brit. Ceram. Soc. Meeting on Nucl. and Eng. Ceram., Harwell, Eng., 25-27 Oct. 1965
(Contract W-7405-ENG-26)
(ORNL-P-1724; CONF-651041-1) CFSTI: HC $2.00/MF $0.50

The results of irradiation tests and complementary supporting research and development that is being done to establish the performance characteristics of vibratorily compacted sol-gel derived ThO_2–UO_2 fuels are presented. The program

includes a comparison of such material with ThO_2–UO_2 dervied from other processes. Irradiation tests with vibratorily compacted thoria-base fuels at linear heat ratings up to 1000 w/cm and burnups in excess of 100,000 Mwd/t showed that this material must be considered as a unique fuel and not just as a UO_2 substitute. Semitheoretical calculations of the minimum possible swelling in UO_2 and ThO_2–UO_2 match closely the experimental evidence and indicate at least a 20% lower swelling rate for bred ^{233}U fissions than for bred ^{239}Pu fissions. The structural stability and higher thermal capability for thoria-base fuels, when compared with UO_2, indicate potential savings in inventory and fabrication costs provided the reactor design is based on these fuel limitations.

NSA

N66-21970# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.

HIGH PERFORMANCE UO_2 PROGRAM Quarterly Progress Report No. 17, Apr.–Jun. 1965

M. F. Lyons, ed. 15 Jul. 1965 95 p refs

(Contract AT(04-3)-189)

(GEAP-3771-17; EURAEC-1512) CFSTI: HC $3.00/MF $0.75

Post-irradiation examination of the maximum thermal performance, high burnup assembly, EX-12A, was essentially completed. The EX-12A fuel rods appeared capable of continued satisfactory operation with no evidence of any significant deterioration. The measured fission gas release fraction varied from slightly greater than 50% for Rod 12KCF to greater than 100% for powder Rod 12GV. Examination of the fuel microstructures indicates evidence of considerably greater melting than expected based on end-of-life thermal performance values. No evidence of UO_2-Zircaloy-2 interaction was detected in any of the rods. Some UO_2-Incoloy interaction was evident in Rod 12KCF where the Incoloy foil overlapped. A capsule containing hypostoichiometric pellets was irradiated and indicated slightly lower thermal conductivity than stoichiometric pellets under the same conditions. However, the interpretation of the results is clouded by the probability that pellet–cladding interface conductivity was low during the irradiation. Two isothermal fission gas release capsule irradiations were operated with a UO_2 sample temperature of 1530 and 1680°C. The measured fission gas release up to 1680°C was 2% or less. The retention of Kr in molten and solidified UO_2 was less than 7×10^{-4} cm^3/gm-atm after heat treatment of the UO_2 at 2900°C for 15 minutes under an approximate pressure of 16 kg/cm^2. Although some bonding between individual small particles occurs at 1900°C, the disappearance of the concrete-like structure in vibratory compacted, arc-fused UO_2 seems to start at about 2000°C for 500 hours at temperature. The molten boundary in partially molten powder samples was indicated by the disappearance of porosity, i.e., the same boundary observed in pellet UO_2. Further experiments with W markers incorporated at UO_2 confirmed earlier results that the appearance of the original solid-liquid interface is altered by subsequent heat treatment below the melting point. Results of out-of-pile studies of Zr and Zircaloy-2 interaction with I_2 are summarized. Two types of I_2 attack were observed: gross pitting with extensive metal removal, and cracking with little or no metal removal. The pitting attack appears to be related to imperfections in the ZrO_2 film and proceeds in the absence of stress on both wire and tube samples. Cracking requires both I_2 and stress and occurred in tubular samples only. The correspondence of the out-of-pile, iodine-induced cracks to the pinhole failures experienced in-pile remains tenuous. The only established similarities are their common transgranular character and the presence of I_2 in each case. Fission product distribution data from a rod operated with gross central melting during irradiation shows that the concentration of most fission products is homogenized both radially and axially within the molten core. Exceptions to this rule are some of the more volatile elements such as Cs. The homogenization indicates mixing from convection in the molten zone and confirms earlier, heat-transfer-derived evidence of molten fuel convection. Fission products were axially distributed in the unmelted shell of UO_2 about in proportion to the integrated average axial neutron flux profile. There is a general correspondence between the alpha autoradiograph characteristics and variations, and analytical measurements of the heavy element concentrations and distributions. The interaction between Zircaloy-2, Incoloy, and UO_2, and between Zircaloy-2 and UO_2, was studied out-of-pile at temperatures to 1300°C for 200 hours. The limiting step in the UO_2-Zircaloy-2 interaction appears to be oxygen diffusion through the oxygen-enriched layer in the Zircaloy adjacent to the reaction interface. Linear extrapolation of the test results indicates a 0.01-cm-thick oxygen rich layer will form in 2 years at 970° K. An Incoloy foil between the Zircaloy-2 and UO_2 prevents their interaction, but the Zircaloy-2 and Incoloy react instead with about the same time and temperature characteristics as UO_2-Zircaloy-2.

NSA

N66-21973# Pratt and Whitney Aircraft, Middletown, Conn. Connecticut Advanced Nuclear Engineering Lab.

FISSION GAS MIGRATION STUDIES IN URANIUM CARBIDE

M. A. De Crescente and E. G. Selleck Oct. 1965 16 p refs

(Contract AT(30-1-2789)

(PWAC-476) CFSTI: HC $1.00/MF $0.50

A technique is described for studying migration of inert gases in nuclear fuels using ion bombardment and replication electron microscopy. Helium atoms were agglomerated into 100–5000 Å bubbles which moved up an indicating temperature gradient. The velocity, which was found to be inversely proportional to bubble size, indicated a surface diffusion controlled mechanism. Author (NSA)

N66-21974# Atomics International, Canoga Park, Calif.

FLIGHT-2: A DATA REDUCTION PROGRAM FOR SNAP 10 A TRANSIENT FLIGHT TEST DATA

E. J. Hammond 26 Aug. 1965 44 p refs

(Contract AT(11-1)-GEN-8)

(NAA-SR-MEMO-11603) CFSTI: HC $2.00/MF $0.50

FLIGHT-2 is a data reduction and analysis program for SNAP 10A transient FLIGHT test data. The purpose of the FLIGHT-2 computer code is to: permit rapid analysis and evaluation of the performance of the SNAP 10A system during its orbital flight and to facilitate reporting of the experimental results to project management. Author (NSA)

N66-21983# Atomic Energy of Canada, Ltd., Chalk River (Ontario).

PROBLEMS OF DEFECTOSCOPIC EXAMINATION OF STRUCTURAL MATERIALS FOR THE REACTOR OF THE FIRST CZECHOSLOVAKIAN ATOMIC POWER STATION

Philip Radislav [1965] 14 p refs Translated from RUSSIAN Presented at the Intern. Atomic Energy Agency Symp. on Non-destructive Testing, Bucharest, 17-21 May 1965 Available from Atomic Energy of Canada, Chalk River: $0.50

(AECL-2286; SM-83/11)

Defectoscopy of complicated and simple components using beta particles, x-radiation, and ultrasonics is discussed, with particular reference to the applications of defectoscopy to the reactor components in the First Czechoslovakian Atomic Power Station. NSA

N66-21984# Atomics International, Canoga Park, Calif.
POST ASSEMBLY ELECTRICAL CHECKOUT OF 10FS-3 IN BUILDING 013
K. C. Klinkner 11 Jun. 1965 90 p
(Contract AT(11-1)-GEN-8)
(NAA-SR-Memo-11436) CFSTI: HC $3.00/MF $0.75

The post-assembly electrical checkout of the SNAP 10A flight system 10FS-3 is reported. Test results, deviations, and recommendations are presented. Author (NSA)

N66-21989# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
APPLICATION OF DIFFERENT METHODS OF NON-DESTRUCTIVE TESTING TO FUEL ELEMENTS OF THE ORGEL TYPE [APPLICATION DES DIFFERENTES METHODES D'ESSAIS NON DESTRUCTIFS AUX ELEMENTS COMBUSTIBLES DUE TYPE ORGEL]
P. Bonnet and J. Jansen [1965] 46 p refs Transl. into ENGLISH from IAEA Preprint SM-63/23 Presented at the Symp. on Non-Destructive Testing in Nucl. Technol., Bucharest, 17-21 May 1965
(AEC-TR-6628)

Non-destructive tests on Orgel fuel elements were made. A comparative description of different methods for the detection of defects is presented. The methods considered are ultrasonics, radiography, Foucault currents, visual inspection, and dimensional metrology. NSA

N66-22017# Southwest Research Inst., San Antonio, Tex.
CONSULTING SERVICES ON THE ADVANCED BONUS CORE BOILER-SUPERHEATER FUEL ELEMENT WELDMENTS Final Report
J. Mc Donald, Jr., E. B. Norris, P. D. Watson, and K. K. Speirs 20 Sep. 1965 176 p Prepared for Combust. Eng., Inc.
(Contract AT(40-1)-3154)
(TID-22425) CFSTI: HC $5.00/MF $1.00

The development and optimization of welding procedures, and the determination of tensile and fatigue data for the produced weldments, are reviewed for several types of welds in Inconel 600 and 625 and Incoloy 800. The weld configurations studied include welds of steam tubes to tube sheets, welds of boiler clad to tube sheets, and tube-to-tube welds. The techniques developed are intended for use in an advanced BONUS core configuration. NSA

N66-22029# Oak Ridge National Lab., Tenn.
EXAMINATION OF IRRADIATED UO_2 PARTICLES FROM AEROJET GENERAL NUCLEONICS
N. A. Krohn and R. L. Pearson Jul. 1965 30 p
(Contract W-7405-ENG-26)
(ORNL-TM-1150) CFSTI: HC $2.00/MF $0.50

Uranium dioxide (93% ^{235}U), with an average particle size of about 1 μ was slurried in liquid ammonia and circulated within the materials testing reactor. Samples of the pre- and post-irradiated material were sent to ORNL, and the specific surface area and O/U ratio of each was determined and compared. An examination of the appearance of the particles before and after irradiation was performed by electron microscopy. The results showed the following: The circulating particles were comminuted, with a resultant fourfold increase in surface area. The O/U ratio was not affected. Author (NSA)

N66-22084# Oak Ridge National Lab., Tenn.
NONDESTRUCTIVE TESTING AT THE HOT LABORATORIES OF THE CEN, GRENOBLE
E. De Robien and A. Lachambre [1965] 15 p Transl. into ENGLISH from French Presented at Symp. Intern. sur les Methodes de Travail Dans les Labs. Chauds de Haute Activite, Grenoble, France, 15-18 Jun. 1965
(ORNL-TR-749)

The diversity of irradiation loops studied in the CENG reactors led to the equipping of the hot laboratory with a large number of devices for nondestructive testing. After a definition of the purpose of the hot laboratory, descriptions are given of the different devices utilized under the following categories: macrographic examination, dimensional, radiographic testing, fission gas sampling, and gamma scanning. Author (NSA)

N66-22074# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
AEROSPACE NUCLEAR SAFETY INVESTIGATIONS OF REENTRY ABLATION PHENOMENA Quarterly Report, 1 May-31 Jul. 1965
J. L. Beal, W. R. Brown, F. A. Vassallo, and D. E. Adams Jul. 1965 47 p refs Prepared for Sandia Corp.
(Contract AT(29-1)-789)
(SC-DC-65-1698; CAL-114-080-2) CFSTI: HC $2.00/MF $0.50

Initial tests in the development of a target impact method for determining the size distribution of debris particles formed in shock tube tests of disintegration during reentry are described. Bench tests of the heating of zirconium hydride and of preheated and non-preheated zirconium specimens are discussed. Author (NSA)

N66-22094# Oak Ridge National Lab., Tenn.
AN INVESTIGATION OF THE POSSIBILITY OF USING THROIUM IN HIGH-ENERGY REACTORS
A. I. Leipunskii, O. D. Kazachkovskii, S. B. Shikhov, and V. M. Murogov [1965] 19 p refs Transl. into ENGLISH from Atomnaya Energ. (Moscow), v. 18, no. 4, 1965 p 342-350
(ORNL-TR-788) CFSTI: HC $1.00/MF $0.50

A description is given of the results of an investigation of the possibility of using ^{233}U and thorium in a system of breeder reactors. It is shown that the most promising from the point of view of doubling time is the joint use of ^{233}U-Th and ^{239}Pu-^{238}U in a combined fuel cycle of fast reactors, provided the thorium is arranged in the shields and the ^{233}U, ^{239}Pu and ^{238}U are in the cores. The burnup and conversion of ^{233}U and ^{239}Pu in a combined fuel cycle is done in such a way that their quantitative ratio remains constant. The doubling time of a system of fast reactors working under conditions of a combined fuel cycle is substantially less than the doubling time of reactors using only ^{233}U and thorium. Thorium is the main raw material in the combined fuel cycle. A method is pointed out for the production of isotopically pure ^{233}U with a ^{233}U content of 10-4%. Author (NSA)

N66-22119# Naval Research Lab., Washington, D. C. Metallurgy Div.
IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS Quarterly Progress Report, 1 Feb.-30 Apr. 1964
L. E. Steele, J. R. Hawthorne, and H. E. Watson 15 May 1964 19 p refs
(Contract AT(49-5)-2110)
(NRL-Memo-1534; AD-602159) CFSTI: HC $0.50/MF $0.50

Data are presented on the following: (1) simulation of periodic in-service annealing of pressure vessel steels for

embrittlement relief, (2) surveillance of radiation embrittlement in Army SM-1A Reactor, and (3) equipment for in-reactor studies of low cycle fatigue performance of steels.
Author (NSA)

N66-22125# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
ACCUMULATION OF BUILD-UP FACTORS: COEFFICIENTS OF THE J. J. TAYLOR EQUATION [SUI FATTORI DI ACCUMULAZIONE: COEFFICIENTI DELLA FORMULA DI J. J. TAYLOR]
S. Buscaglione and R. Manzini Jan. 1965 11 p refs In ITALIAN
(PT/FI(65)-7)

Build-up factor's coefficients of J. J. Taylor equation were determined, for some of the most common materials for the construction of gamma shielding. The materials investigated are: H_2O, Al, Fe, Pb, Sn, W, U; as well as ordinary concrete, barites concrete, ferrophosphorus concrete and magnetite concrete.
Author (NSA)

N66-22145# Institutt for Atomenergi, Kjeller (Norway).
CORRELATION BETWEEN CALCULATED AND MEASURED MECHANICAL PROPERTIES OF THIN-WALLED FUEL ELEMENT CANNING TUBES OF STAINLESS STEEL
Erik Brodahl and Steinar Aas Jul. 1965 27 p refs
(KR-96)

Burst and collapse tests were performed on half-hard and annealed tubes of AISI 304 L stainless steel at room temperature and at 300°C. Tensile test specimens were taken from the same tubes and tested at the same temperatures. From stress–strain diagrams, material constants were determined and the yield, burst, and collapse pressures were calculated according to classical formulas and the results correlated with the experimental data. The results showed that the classical formulas predict adequately the critical dimensions or the critical pressures. Internally supported tubes were collapsed at 300°C in order to study the effect of the gap between the support and inner tube wall.
Author (NSA)

N66-22163# Hanford Atomic Products Operation, Richland, Wash. Physics and Instruments Lab.
SCINTILLATION AND NEUTRON FISSION TECHNIQUES FOR NONDESTRUCTIVE TESTING OF LOW-LEVEL URANIUM CONTAMINATION ON N REACTOR FUEL
Charles N. Jackson, Jr. Mar. 1964 33 p refs
(Contract AT(45-1)-1350)
(HW-SA-3469) CFSTI: HC $2.00/MF $0.50

A tester was developed and fabricated that detects the alpha decay from ^{238}U and ^{234}U. It was used to measure fuel element uranium surface contamination of 10 to 100 μg as a production line test. It contains a zinc sulfide scintillation system that can test a 118 $in.^2$ surface at one time. In a 13 minute test, it was used to measure the quantity of contamination with an estimated accuracy of ±25% at 100 μg. The alpha count rate is from 0.4 to 0.7 counts/min/μg from the uranium depending on the size of the area being tested. It was also used to pinpoint manufacturing operations that had resulted in uranium contamination of N-Reactor fuel elements. Cladding with up to 100 μg of contamination was traced to oxidation testing in a specific autoclave. Fuel and caps with up to 300 μg of contamination were traced to the end cap assembly operation. The tester was used to investigate the effects of various parameters in both of these operations. It was found that it has potential for greater throughput by use of a go, no-go mode of operation that would shorten the test time to 6 min or less. It was possible to achieve needed sensitivity and microscopic detail by the use of the neutron fission technique. Accurate measurements were obtained in the 2,000 to 20,000 ppm range. The plastic detector proved much easier to use than the mica because the tracks are easier to see and count. Scanning to locate contaminated areas can be accomplished at 10× magnification with the plastic whereas the mica required 100×. This technique, though not developed to the status of a production test, is at the very minimum an excellent backup test for the alpha counting technique. The neutron fission technique has excellent capabilities for future growth because of its potentially greater sensitivity which can be achieved simply by increasing the size of the neutron dose.
NSA

N66-22187# Metallgesellschaft, A. G., Frankfurt am Main (West Germany).
FURTHER DEVELOPMENT OF THE ZIRCONIUM ALLOY ZrNb3Sn1 WITH A VIEW TO ITS APPLICATION AS JACKETING MATERIAL IN WATER-COOLED NUCLEAR REACTORS Quarterly Report No. 3, 1 Apr.–30 Jun. 1964
7 Jul. 1964 16 p refs Transl. into ENGLISH from German
(Contract EURATOM-019-63-11 TEED)
(EURAEC-1115)

ZrNb3Sn1 alloys with small admixtures of chromium, iron, germanium, copper, antimony, tellurium and vanadium were examined in comparative corrosion experiments in superheated steam at 400° and 450°C. After 1000 hours in superheated steam at 450°C, the following alloys show a considerably lower corrosion than the ZrNb3Sn1 alloy: (1) ZrNb 2.78 Fe 0.1, (2) ZrNb 2.78 Sn 0.3 Fe 0.1, (3) ZrNb 2.78 Sn 1 Fe 0.1, (4) ZrNb 1.90 Sn 1 Fe 0.5, (5) ZrNb 2.34 Cu 0.2, (6) ZrNb 2.34 Sn 0.6 Cu 0.2, (7) ZrNb 1.74 Cr 0.5, (8) ZrNb 2.56 V 0.1–Sn 0.3, (9) ZrNb 2.04 Sb 0.2, (10) ZrNb 2.04 Sb 0.2–Sn 0.3. Large cast ingots were smelted from these alloys and prepared as test material for more thorough corrosion experiments and for mechanical examination. Creep test experiments at 450°C, and tensile tests at room temperature and 450°C were started. The stress in the creep tests amounted to 3 and 4.5 kg/mm^2 respectively.
Author

N66-22205*# Oak Ridge National Lab., Tenn.
SNAP-8 CORROSION PROGRAM Quarterly Progress Report, Period Ending 31 May 1965
H. W. Savage, E. L. Compere, R. E. Mac Pherson, W. R. Huntley, and A. Taboada Sep. 1965 20 p refs
(NASA Order C-220-A; Contract W-7405-ENG-26)
(NASA-CR-67272; ORNL-3859) CFSTI: HC $1.00/MF $0.50
CSCL 18N

Corrosion loops for the SNAP-8 system were studied to determine differences in corrosion and mass transfer rates resulting from continuous cold trapping, and to evaluate the effectiveness of cold trapping in reducing the hydrogen concentration in the NaK loop. Extraneous hydrogen was observed with both an on-stream mass spectrometer and gas sampling techniques, however the rate of extraneous hydrogen diminished with time. Deuterium was introduced into the loop to distinguish between extraneous hydrogen and that injected into the loop. Data indicated that the equilibrium pressure in the loop is approximately the same as the calculated hydrogen partial pressure for the SNAP-8 primary system in space. A study was made to determine the effects of decarburization on selected mechanical properties of Croloy 9M. Sheet tensile specimens were decarburized to a carbon content of approximately 0.002 to 0.01%, by exposure to

NaK in a forced flow type 316 stainless steel loop. A general deterioration of their mechanical properties was observed. H.S.W.

N66-22285*# National Aeronautics and Space Administration, Washington, D. C.
DIRECT CONVERSION INTO ELECTRICAL ENERGY OF GAMMA RADIATIONS EMITTED BY NUCLEAR REACTORS OR RADIOISOTOPES [CONVERSIONE DIRETTA IN ENERGIA ELETTRICA DI RADIAZIONI GAMMA EMESSE DA REATTORI NUCLEARI O DA RADIOISOTOPI]
Carlo Roma Feb. 1966 23 p Transl. into ENGLISH from Ric. Sci. (Rome), Pt. II-A, v. 8, no. 4, Jul.–Aug. 1965 p 923–935
(NASA-TT-F-9887) CFSTI: HC $1.00/MF $0.50 CSCL 18L

A new technique of direct conversion of gamma radiations into electrical energy is described. It is based on the production of electrons—mainly through the Compton effect—in two electrodes of the same material and insulated in a vacuum, whose thicknesses are in a high ratio between themselves. The electrons produced possess sufficient energy for the range associated with it to permit them to leave the thickness of the electrodes. Assuming the photons to be monoenergetic and their flux density (the flux assumed to be collimated) to be known, current density, theoretical power, and the power dissipated by ionization are determined with the help of statistical considerations. Losses influencing conversion gain are specified. Author

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N66-21289# Naval Research Lab., Washington, D. C.
VALUES FOR SCATTERING BY DIELECTRIC SPHERES IN THE REGION OF THE FIRST RESONANCE Final Report
W. C. Keller 30 Dec. 1965 39 p refs
(NRL-6365; AD-627347) CFSTI: HC $2.00/MF $0.50

The scattering intensity as a function of sphere size in wavelengths was plotted for H-plane scattering at 90° in the region of the first resonance. Graphs of K (the dielectric constant) from 5 to 24 and tan delta (the loss tangent) from 0.001 to 0.2 are presented for nonmagnetic spheres in vacuo. The purpose of these data is to serve as a comparison standard in evaluating K and tan delta by scattering measurements on a spherical sample. The experimental method is described in 'A Method of Determining the Dielectric Constant Applicable to High Temperatures,' published in the 'Proceedings of the USO-RTD Electromagnetic Window Symposium,' Vol. III, June 1964. Author (TAB)

N66-21325# RAND Corp., Santa Monica, Calif.
NUMERICAL INVERSION OF LAPLACE TRANSFORMS AND SOME INVERSE PROBLEMS IN RADIATIVE TRANSFER
R. E. Bellman, H. H. Kagiwada, and R. E. Kalaba Dec. 1965 25 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4856-PR; AD-626945) CFSTI: HC $1.00/MF $0.50

A consideration of a semi-infinite homogeneous slab atmosphere that absorbs radiation and scatters it isotropically. A basic inverse problem is the determination of the source function, given the angular dependence of the emergent radiation. The authors show how to solve this problem, making use of previous work on the numerical inversion of Laplace transforms. Author (TAB)

N66-21341# Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
RIPPLE TANK ANALOGS OF ELECTROMAGNETIC SCATTERING BY METALLIC AND DIELECTRIC CYLINDERS
James E. Burke and Victor Twersky 29 Oct. 1965 69 p refs
(Contract DA-28-043-AMC-00379(E))
(EDL-M810; AD-627242) CFSTI: HC $3.00/MF $0.75

Because of their utility as analog computers for studying the scattering of electromagnetic and acoustic waves, two ripple tanks were built up as part of the equipment used in the Laboratory's basic studies in scattering. These facilities are described in detail and data obtained with them are discussed. Results for two fundamental scatterers, elliptic and triangular dielectric cylinders, are emphasized. (Although the ellipse is a simple shape, and the corresponding perfectly conducting scatterer leads to a separable boundary value problem, the dielectric case is not separable in the usual sense. Similarly, the results for triangular cylinders model some aspects of the unsolved problem of scattering by a dielectric wedge.) Several analogs of scattering by metallic objects (cylinders, gratings, mirrors, etc.) are also considered in order to illustrate the overall utility of the ripple tanks for initial considerations of many practical propagation problems; the design of radar antennas, the analysis of interference patterns for complex arrays, the study of acoustic waves in bounded domains, etc. Author (TAB)

N66-21396# Block Engineering, Inc., Cambridge, Mass.
MEASUREMENTS IN THE FAR INFRARED Final Report, 1 Apr. 1962–30 Sep. 1965
Amos Engelsrath Dec. 1965 79 p refs
Contract AF 19(628)-484)
(AFCRL-65-905; AD-628134) CFSTI: HC $3.00/MF $0.75

This work consists of two independent parts. Part one deals with the optical and dispersion constants of quartz in the infrared and discussion of a general method of finding optical constants of dielectrics from two reflection measurements of plane polarized light. A discussion of the pro and con of this method is included and the error in the optical constants found. Part two deals with the construction and operation of a Michelson interferometer. This part includes the operation and properties of cooled bolometers used with the interferometer. Author (TAB)

N66-21499# J. G. Engineering Research Associates, Baltimore, Md.
INTEGRAL EQUATION SOLUTION FOR A FREE FLOODING CYLINDRICAL SOUND RADIATOR OF FINITE LENGTH
Joshua E. Greenspon Sep. 1965 27 p refs
(Contract Nonr-2733(00))
(TR-14; AD-627078) CFSTI: HC $2.00/MF $0.50

The solution for the finite free flooding cylinder is built up from the solution for a ring on an infinite rigid baffle. The

velocity in the field at the ends of the cylinder is the solution of an integral equation which was originally derived by Junger. A computer program has been developed for solving this integral equation and for obtaining the radiation impedance of the cylinder. It is found that the velocity near the ends of the cylinder is highly attenuated within 1/8 wave length away from the ends. Just at the ends the velocity changes radically but this violent changing stops at less than 1/4 wave length from the ends of the cylinder, at which point a regular attenuated sine wave starts. Author (TAB)

N66-21648*# Alabama Univ. Research Inst., Huntsville.
SCATTERING FROM BODIES OF REVOLUTION BY POINT-MATCHING
H. Y. Yee Dec. 1965 33 p refs
(Grant NsG-381)
(NASA-CR-71340; UARI-31) CFSTI: HC $2.00/MF $0.50 CSCL 20N

The application of the point-matching method to three-dimensional problems is formulated in this report. Investigations are started from the scattering of plane waves by accoustically soft and hard bodies of revolution. Due to the symmetry of the scatterer, the incident wave is expanded in Fourier series of azimuth angle. A number of systems of simultaneous inhomogeneous algebraic equations is necessary to obtain a solution. Each of these systems of equations is quite similar to that of the two dimensional problem. The accoustic formulation is extended to obtain the solution for scattering of electromagnetic plane waves by perfectly conducting rotational symmetric bodies. In this case, the boundary conditions consist of two tangential components of the electric field which vanish at the surface of the scatterer. However, the resultant equations are in the same form as in the accoustic problem. Author

N66-21687*# National Aeronautics and Space Administration, Washington, D. C.
OPTIMUM MOTION IN A CENTRAL FIELD WHEN THE OPERATION TIME OF A PROPULSION SYSTEM IS GIVEN [OPTIMAL'NOYE DVIZHENIYE V TSENTRAL'NOM POLE PRI ZADANNOM VREMENI RABOTY ISTOCHNIKA MOSHCHNOSTI]
Yu. N. Ivanov and V. A. Vinokurov Jan. 1966 9 p ref Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. i Mashinostr. (Moscow), no. 5, 1965 p 56–69
(NASA-TT-F-9892) CFSTI: HC $1.00/MF $0.50 CSCL 20

A method was proposed for solving the variational problem of maximum useful load delivery from a motor with limited power in a given operating time. For plane-parallel and zero-force fields, the variational problem is completely solved. A similar formulation of the variational problem for a central field requires a numerical solution. In this paper the authors solve the variational problem for flight between circular orbits in a central field. A motor with limited power is assumed which is ideally controllable. The operating time of the motor is given and is less than the time of motion. In section 1, the problem is formulated and reduced to a boundary problem for ordinary differential equations. The method for solving this boundary problem is set forth in section 2, and the results of calculations are given in section 3. Author

N66-21761# Air Force Academy, Colo. Frank J. Seiler Research Lab.
REGULARIZATION AND POWER SERIES SOLUTION FOR THE THIRD ORDER REPRESENTATION OF THE RESTRICTED 3 BODY PROBLEM Final Report
Allan F. Schanzle Dec. 1965 23 p ref
(SRL-65-0009; AD-627653) CFSTI: HC $1.00/MF $0.50

The equations of motion for the planar, circular restricted three body problem are reduced from the fourth order to a third order system by introducing a new variable. Assuming a power series solution, recurrence formulae are derived for the purposes of numerical integration. Convergence of the series is proved except for three singularities, which are eliminated by regularization. Author (TAB)

N66-21799# *General Electric Co., Schenectady, N. Y. Research Lab.
STATIC OPTIMIZATION OF A DYNAMIC PROCESS
J. C. Friedly Jul. 1965 35 p refs
(Rept.-65-RL-3981-E)

The effectiveness of using a static optimization procedure to optimally control a dynamic process is considered, emphasizing the importance of the system time constants relative to the sampling time. A linear model of a chemical process is developed and used to obtain quantitative results on the performance of the control. A comparison is made of the system performance using quasi-static and dynamic optimization. Author

N66-21804# Liege Univ. (Belgium). Lab. of Aeronautics and Space Techniques.
STUDY OF THE ELECTRODYNAMIC EXCITER [ETUDE DE L'EXCITATEUR ELECTRODYNAMIQUE]
R. Pendville Oct. 1964 26 p In FRENCH
(VP-6) CFSTI: HC $2.00/MF $0.50

A reference, i.e., a signal in phase with the force or out of phase with a known angle, was determined in order to enable measurements of the phase difference between the exciting force and the displacement of a point of an excited system. A schematic description of the shaker showing its magnetic and electrical circuits precedes the theoretical study which consists of observing the units intervening in the Laplacian equation F = BIl. The results of the measurements taken with the diagrams lead to the experimental determination of the phase difference between the force and the current chosen as reference of phase. Transl. by D.T.

N66-21885# Oxford Univ. (England). Dept. of Theoretical Physics.
THEORIES OF MAGNETISM First Annual Technical Report, 1 Oct. 1964–30 Sep. 1965
R. J. Elliott [1965] 16 p refs
(Contract DA-91-591-EUC-3402)
(AD-624792) CFSTI: HC $2.00/MF $0.50

The Kondo effect and the theory of spin waves are discussed. The minimum in the resistance of several metals has been traced to transition metal impurities in tiny concentrations. Kondo has shown that the effect follows from the existence of localized spins on the impurity. The scattering of conduction electrons from a center with an internal degree of freedom has an essential many-body character. When the exchange coupling between the conduction electrons and the localized spin is antiferromagnetic he found as T approaches 0 a logarithmic divergence in third-order perturbation theory which gave an increase in the resistivity as T decreased and hence a minimum when added to the ordinary term. The interaction between a pair of spins was examined. Several aspects of spin wave theory were considered. A space group theory was set up to describe the form of spin wave spectra, calculate selection rules, etc. TAB

N66-21914# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Electrophysics.
RAY THEORY OF OPTICAL RESONATORS AND BEAM WAVEGUIDES
Walter K. Kahn Jul. 1965 40 p refs
(Contract AF 49(638)-1402)
(PIBMRI-1285-65; AD-628355) CFSTI: HC $2.00/MF $0.50

Important characteristics of optical resonators and beam waveguides can be inferred from simple ray-optical considerations. The ray theory is susceptible of an extremely convenient algebraic formulation from which formal analogs in terms of electrical networks are evident. In laser applications of optical resonators the medium is certainly inhomogeneous and dispersive. A ray analysis is carried through for a resonator containing an inhomogeneous medium, and yields some very interesting general conclusions. The stability of the ray systems within the resonator, i.e., high and low loss configurations are discussed in terms of a generalization of Pierce's criterion. It is shown that the law for the variation of the spot size within an (empty) optical resonator of the generalized confocal type may be deduced from geometric optical considerations. The variation is identified with the envelope of a system of rays within the resonator. When a resonator is filled with a convergent inhomogeneous medium, stable and unstable (high and low loss) configurations are shown to recur periodically with mirror separation.
Author (TAB)

N66-21925# Harvard Univ., Cambridge, Mass. Cruft Lab.
NONLINEAR FEEDBACK SOLUTION TO A BOUNDED BRACHISTOCHRONE PROBLEM IN A REDUCED STATE SPACE Interim Technical Report
Jason L. Speyer Dec. 1965 24 p refs
(Contract Nonr-1866(16))
(TR-492; AD-627647) CFSTI: HC $1.00/MF $0.50

The optimal nonlinear feedback law for both an unbounded and bounded Brachistochrone problem is given. These control laws describe the Brachistochrone problem in a very simple manner. These laws are derived by using a dimensionless set of state variables which are of lower dimension than the original state space. Also using this reduced state space a two dimensional instead of three dimensional field of extremals is constructed for the bounded Brachistochrone problem. This illustrates that the state space may be reduced so that the storage of a field of extremal trajectories will not exceed the storage capacity of a practical on board computer. In this way, optimal feedback control may become a practical technique for a larger class of nonlinear systems.
Author (TAB)

N66-21946# European Organization for Nuclear Research, Geneva (Switzerland).
THE LIOUVILLE THEOREM AND THE GENERAL PROBLEM OF STABILITY [LE THEOREME DE LIOUVILLE ET LE PROBLEME GENERAL DE LA STABILITE]
J. Fronteau 12 Nov. 1965 36 p refs In FRENCH; ENGLISH Summary Submitted for Publication
(CERN-65-38)

The Liouville theorem, of which the theorem of conservation of volumes in phase space is a specific case, is studied. The relations of the Liouville theorem to the general stability problem are shown. It is also shown that the theorem links the behavior of systems in relativistic frames of reference with that in nonrelativistic reference frames.
NSA

N66-21968# Stanford Univ., Calif. Linear Accelerator Center.
A GENERAL FIRST-ORDER AND SECOND-ORDER THEORY OF BEAM TRANSPORT OPTICS AND ITS APPLICATION TO THE DESIGN OF HIGH-ENERGY PARTICLE SPECTROMETERS
Karl L. Brown Aug. 1965 24 p refs Presented at the 5th Intern. Conf. on High Energy Accelerators, Frascati, Italy
(Contract AT(04-3)-400)
(SLAC-132; CONF-650923-24) CFSTI: HC $1.00/MF $0.50

A general first and second order theory of beam transport optics was developed. From this the first and second order matrix elements of bending magnets, quadrupoles, and sextupoles were derived. Utilizing this theory, very general first and second order theorems of beam transport optics were formulated which were extremely useful for designing single and multiple element magnetic optical systems. The theorems are expressed as functions of five characteristic first order trajectories of a system. In fact, all of the first and second order optical properties of a system may be expressed in terms of these five trajectories. A general discussion of the theory is presented along with specific applications of the theory to the design of high energy particle spectrometers.
Author (NSA)

N66-21991# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-12 Plant.
OPTICAL APPLICATIONS IN DIMENSIONAL GAGING
L. G. Whitten 29 Nov. 1965 19 p
(Contract W-7405-ENG-26)
(Y-KE-191) CFSTI: HC $1.00/MF $0.50

The use of optics in the fields of length, straightness, and surface finish is discussed. Both advantages and disadvantages for optics are listed. However, it was concluded that the use of optics in these fields are unparalleled by any other method.
NSA

N66-22032# New Mexico State Univ., University Park.
PROPAGATION OF AN ELECTROMAGNETIC WAVE IN A TIME-VARYING MEDIUM. PART II: SQUARE-WAVE MODULATION OF THE PERMITTIVITY
Kaiser S. Kunz Dec. 1964 42 p Prepared for Sandia Corp.
(Contract AT(29-1)-789)
(SC-R-64-1378) CFSTI: HC $2.00/MF $0.50

The propagation of electromagnetic waves in a medium whose effective dielectric constant and conductivity vary with time according to a square wave modulation is studied. The equation for the static case is solved, and simplifications from the use of eigenvalues and eigenvectors are discussed. Square wave modulation of a lossless medium, with constant zero conductivity, is considered for the dynamic, stable, and transition regions. Regions of stability and instability are defined for the case where the time spent by the permittivity at its higher value equals that spent at the lower value. The behavior of the solutions is studied for symmetry with respect to space and time reversals.
NSA

N66-22033# New Mexico State Univ., University Park.
PROPAGATION OF AN ELECTROMAGNETIC WAVE IN A TIME-VARYING MEDIUM. PART I: GENERAL THEORY
Kaiser S. Kunz Oct. 1964 24 p refs Prepared for Sandia Corp.
(Contract AT(29-1)-789)
(SC-R-64-1361) CFSTI: HC $1.00/MF $0.50

A firm mathematical basis for the treatment of electromagnetic waves in time-varying media is established. The

medium is assumed conductive, nonhomogeneous, and time-varying, but is isotropic with linear relations between $\vec{D}$ and $\vec{E}$, $\vec{B}$ and $\vec{H}$, and $\vec{J}$ and $\vec{E}$, which define the macroscopic properties ϵ, μ, and σ of the medium. Wave equations for the field vectors are derived. The wave equation is solved for a homogeneous medium with time-varying parameters ϵ, μ, and σ, and it is shown how the solution may be made to satisfy simple boundary conditions. NSA

N66-22053# Cornell Univ., Ithaca, N. Y. Lab. of Atomic and Solid State Physics.

JOULE LOSS IN A "PERFECT" CONDUCTOR IN A MAGNETIC FIELD

J. M. Goodman and C. R. Legendy 1 May 1964 24 p refs *Its* Rept.-201

(Contract AT(30-1)-2179)

(TID-21171) CFSTI: HC $1.00/MF $0.50

Calculations of the skin effect in the presence of a magnetic field exhibiting some novel features in the dependence of the power absorption on frequency and conductivity are presented. In particular, in the limit of classical "perfect" conductivity (in which $\sigma \to \infty$ but the effects of finite electron mean free path and scattering time are neglected) the loss tends to a nonzero limit independent of the conductivity and is confined to the surface. For available fields and sample conductivities, this limiting case is a good approximation at low frequencies and is relevant to many studies of helicons in metals. Data from a preliminary experiment on sodium at 4.2°K in a 55 kG magnetic field for frequencies below a few kilocycles are presented and analyzed. Author (NSA)

N66-22102# Purdue Univ., Lafayette, Ind. Chemical Engineering Labs.

SUSPENSIONS OF SOLIDS IN LIQUIDS BY FAN TURBINE IMPELLERS. EFFECT OF SIZE, GEOMETRY, AND FLUID PROPERTIES

J. Henry Rushton and Verne W. Smith, Jr. [1965] 38 p refs

(Contract AT(11-1)-804)

(TID-22075) CFSTI: HC $2.00/MF $0.50

The conditions required for suspension of various weight percents of three size ranges of glass beads in liquids of different densities and viscosities were studied in three sizes of tanks using three geometrically similar fan turbine impellers and three impeller positions. The effects these conditions had on the ability of the systems to suspend the solids were correlated as follows: $N_c = 65\ D^{-0.45}\ (T/D)^{0.25}\ (d/D)^{0.2}\ (C/D)^{0.5}\ W^{0.1}\ (\Delta\rho/\rho_L)^{0.3}\ \rho_L^{-0.3}\ \mu^{-0.02}$, where N_c is the impeller speed just necessary to lift all solids from the tank bottom, D is the impeller diameter, T is the tank diameter, d is the average solids diameter, C is the height of the impeller above the tank bottom, W is the weight percent solids, ρ_L is the density of the liquid, $\Delta\rho$ is the difference between solid and liquid densities, and μ is the liquid viscosity. The point of complete suspension was determined by a light transmittance technique. The constant K and the exponents were found to be constant values over the ranges studied. The effects of geometric changes in the system on the ability to suspend solids can be illustrated through a power per unit volume equation which is: $P/V = 0.05\ D^{0.65}\ (T/D)^{-2.25}\ (d/D)^{0.6}\ (C/D)^{1.5}\ W^{0.3}\ (\Delta\rho/\rho_L)^{0.9}\ \rho_L^{0.1}\ \mu^{-0.08}$. The power requirements for a fan turbine were compared with those of a flat-blade turbine for solid-liquid systems and found to be less in most cases. Also, a comparison of the power required for various impeller speeds with and without solids present in the system was made and no definite difference was found. Author (NSA)

N66-22104# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.

ULTRAHIGH VACUUM TECHNIQUES Annaul Report, Jan. 1–Dec. 31, 1964

W. J. Lange and J. H. Singleton [1964] 48 p refs *Its* Res. Rept.-65-9E1-441-R2

(Contract AT(30-1)-2823)

(WERL-2823-17) CFSTI: HC $2.00/MF $0.50

The operation and errors of a modulated Bayard–Alpert ion gage were studied. Oxygen pressure measurements by an ion gage, a modulated ion gage, and a mass spectrometer are discussed. The efficiency of an electron multiplier after activation and exposure to various gages was studied. Other vacuum techniques which were studied included removal of residual CO_2 from ultrahigh vacuum systems, tests of gold gaskets, outgassing of electron storage rings, and Teflon coating of vacuum system walls. The desorption of CO and H_2 from tungsten and stainless steel by heat and photons was studied. The work on the interaction of O_2 with tungsten was continued. NSA

N66-22233*# Rochester Univ., N. Y. Inst. of Optics

ULTRAVIOLET INTERFERENCE FILTERS

Verne Robert Costich (Ph.D.Thesis) 1965 140 p refs Sponsored by NASA

(NASA-CR-70638) CFSTI: HC $4.00/MF $1.00 CSCL 20F

Systematic techniques for designing ultraviolet bandpass interference filters are developed and illustrated in an example, which has a peak transmittance of 0.64 at 0.2537 microns, a full bandwidth at half-maximum of 0.0065 microns, and 0.025 background transmittance. The contrast and peak transmittance are computed and illustrated as functions of the thickness, refractive index, and absorption constant of the metal film. Since aluminum is the best metal to use in this type of ultraviolet filter, the peak transmittance, contrast, and bandpass are indicated for aluminum versus film thickness and wavelength. Several experimental bandpass filters were produced using aluminum. The measured transmittance properties of these filters parallel closely their computed curves. Among the experimental parameters varied are the phase dispersion and absorption in the anti-reflection stacks, the aluminum film thickness, and the film thickness monitoring procedure. R.N.A.

N66-22236*# Naval Research Lab., Washington, D. C. E. O. Hulbert Center for Space Research.

ON ERRORS IN USING THE REFLECTANCE vs ANGLE OF INCIDENCE METHOD FOR MEASURING OPTICAL CONSTANTS

W. R. Hunter 8 Mar. 1965 28 p refs Submitted for Publication Sponsored in part by NASA *Its* Rept.-7140-PRR-4/65

(NASA-CR-63954) CFSTI: HC $2.00/MF $0.50 CSCL 20F

Several experimental methods have been devised to determine optical constants, the index of refraction, n, and the extinction coefficient, k, by means of reflectance measurements only. However, only one is useful in all wavelengths since all the others make some use of polarized incident radiation. This one method uses incident radiation which is unpolarized and is thus easy to obtain. In this R vs Φ method, the reflectance, R, is measured for two or more angles of incidence, Φ, and the generalized Fresnel reflection equations, connecting R with n, k, and Φ are solved for n and k. This pwper presents a study of the sensitivity of, and the effect of errors on this R vs Φ method. Although undertaken in connection with an investigation of the optical properties of materials in the extreme ultraviolet, the study was broadened

to include the reflectances R_s and R_p for incident radiation polarized with the electric vector perpendicular, and parallel respectively, to the plane of incidence. R.N.A.

N66-22301*# National Aeronautics and Space Administration, Washington, D. C.
TURBULENCE STUDIES IN CONJUNCTION WITH THE DETERMINATION OF THE ACOUSTIC CHARACTERISTICS OF A JET [ISSLEDOVANIYE TURBULENTNOSTI V SVYAZI S OPREDELENIYEM AKUSTICHESKIKH KHARAKTERISTIK STRUI]
Ye. V. Vlasov Feb. 1966 15 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 8, no. 5, 1965 p 568–573
(NASA-TT-F-9896) CFSTI: HC $1.00/MF $0.50 CSCL 20A

Experimental determination of the components of flow fluctuation rate, the turbulent vortex volume, and the turbulent fluctuation frequency in order to make use of the Lighthill equation in determining the acoustic power of a free turbulent jet. The equation is used to obtain from jet velocity fluctuation components the spectra of the longitudinal, tangential and radial components and acoustic power of the jet. Author

N66-22330* National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
SOUND PRESSURE ESTIMATIONS FROM A POINT DIRECTIONAL ACOUSTIC SOURCE RADIATING IN AN INHOMOGENEOUS MEDIUM
Jess H. Jones *In its* Aero-Astrodyn. Res. Rev. No. 3 15 Oct. 1965 p 2–9 refs (See N66-22329 11-34) CFSTI: HC $4.00/MF $1.00

This report concerns a general expression that can be used to make estimates of sound pressures received from a rocket exhaust that radiates in an inhomogeneous medium. The concepts concerning acoustic wave propagation are combined with those having to do with a broad frequency band, directional acoustic source, etc.; in brief, rocket exhaust flow. The ray acoustics approach is used in this paper; there is no attempt to elaborate on the failure of the race trace method to obtain pressure levels for special conditions. The ray trace technique is used only to describe the relationship between horizontal source-to-receiver distance and the angle of emergence of the sound ray. Author

N66-22367*# Aero Vac Corp., Troy, N. Y.
INVESTIGATION OF VACUUM PUMPING ON BEDS OF SOIL MATERIALS Final Report
16 Feb. 1966 20 p
(Contract NAS1-5434)
(NASA-CR-66079) CFSTI: HC $1.00/MF $0.50 CSCL 14B

The purpose of the investigation was to determine the pumping load and time required if beds of soil materials are placed in a vacuum chamber. The vacuum chamber used had a volume of approximately four cubic feet and could be pumped down to 10^{-8} torr when empty. Various sizes of soil beds were placed in the chamber. The beds were composed of either 500 micron or 5 micron particles of aluminum oxide. No particular difficulty was encountered in pumping beds of dry material (less than 0.1 percent moisture). A bed of fine material with 0.5 percent moisture erupted violently, due to sudden release of the moisture from the bed. Author

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N66-21181 Nihon Univ., Tokyo (Japan). Dept. of Physics.
LARGE t LIMIT OF THE COMPTON SCATTERING OF A VECTOR PHOTON BY A SCALAR NUCLEON IN 6TH ORDER DIAGRAM
Jun Otokozawa [1965] 18 p refs
CFSTI: HC $1.00/MF $0.50

Sixth order diagrams for Compton scattering of a massless vector photon by a scalar nucleon are evaluated in the large t limit. The leading term in t for largest invariant amplitudes are found to be $\ln^4 t$ compared to $\ln^2 t$ for the case of scattering of finite mass photon. The same situation also holds for other smaller invariant amplitudes, i.e., the magnitude in large t limit increases by factor $\ln$ or $\ln^2 t$ if we put the photon mass zero. Regge behavior in this case is discussed in detail. Author

N66-21182# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
UNITARY SYMMETRY AND THE HIGH-ENERGY PHOTONUCLEAR REACTIONS
J. Leite Lopes Feb. 1966 27 p refs
(TH/129) CFSTI: HC $2.00/MF $0.50

A mathematical model is constructed for establishing sets of relations among the amplitudes of several photonuclear reactions which lead to the production of mesons, baryons, resonances, and hypernuclei. Matrix element relationships for single meson production in a photoproton reaction are reviewed, and the relations among the amplitudes are deduced for the photoproduction of meson pairs on proton. An example for the case of the photoproduction of three mesons on proton is also given. Some channels for the photodisintegration of helium are considered, to obtain simple amplitude relations. Amplitudes are related for the production of single mesons in the photodisintegration of the deuteron, and relations are given which correspond to the production of baryon resonances in this reaction. E.A.O.

N66-21201# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
OCTUPOLE COULOMB EXCITATION OF ^{208}Pb NUCLEUS [OKTUPOLOWE WZBRDZENIE KULOMBOWSKIE JADRA ^{208}Pb]
A. Z. Hrynkiewicz, S. Kopta, I. Kuzniecow, S. Szymczyk, and T. Walczak (Joint Inst. for Nucl. Res.) Nov. 1965 24 p refs Submitted for Publication
(REPT.-431/PL) CFSTI: HC $1.00/MF $0.50

Carbon-12 ions with energies of 45.5 to 60.2 MeV were used to Coulomb excite 3^- state in the doubly magic nucleus ^{208}Pb. The experimental proof that 2615 keV γ-ray yield results from Coulomb excitation of ^{208}Pb is given. The determined reduced transition probability $(B(E3)\uparrow = (0.83 \pm 0.18/0.25)e^2b^3$. Author

N66-21214# Tokyo Univ. (Japan). Dept. of Physics.
THEORY OF THE WEAK INTERACTIONS
Seitaro Nakamura [1965] 38 p refs Presented at the Intern. Conf. of Elementary Particles (Kyoto), 24–30 Sep. 1965
CFSTI: HC $2.00/MF $0.50

The following topics are considered: intermediate boson theory, interaction of pion and kaon, mass differences of particles depending on the electric charge, charge dependence of nuclear force, and the universal weak Yukawa interactions and the intermediate bosons. Varieties of the intermediate bosons for the weak interactions are listed. M.R.W.

N66-21226# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
THE FLUORESCENCE YIELDS OF GOLD AND URANIUM
M. A. Di Lazzaro and G. Missoni 3 May 1965 41 p refs Sponsored by the Consiglio Nazionale delle Ricerche
(ISS-65/11) CFSTI: HC $2.00/MF $0.50

A simple procedure used to measure some L-shell fluorescence yields, is reported. It consists in measuring the concidence counting rate between X_K and X_L fluorescence photons emitted from a target stuck by γ-rays. Measured values of ω_{L2}, ω_L and ω_{KL}, related to uranium and gold, are reported and compared with similar values obtained by other authors. Author

N66-21241# Library of Congress, Washington, D. C. Aerospace Technology Div.
FOREIGN SCIENCE BULLETIN, VOLUME 1, NUMBER 12
Dec. 1965 68 p refs

A selection of foreign scientific and technical papers is reviewed. The following topics are considered: the primary cosmic rays of the sun and their decomposition into secondary components in the terrestrial atmosphere, optimum acceleration of a spacecraft in a central field, combustion stability of spherical flames, theory of optimal alloying, the energy of ball lightning, scientific and documentation activities in the Soviet Union, use of a pulsed magnetic field in microwave power generation, and loosening of solids in plastic state. Reports are given on the following conferences: Activities of the Armenian Academy of sciences, relativistic astrophysics, quantum electronics research, scientific session on the application of nuclear methods to solid-state physics, spectroscopy, and theory and applications of explosions. A brief summary of the achievements and accomplishments of two science personalities, Serafim Nikolayevich Zhurkov and Zakhar Aleksandrovich Rogovin, are presented. Book reviews on the following texts are also included: *Long-range Tropospheric Propagation of Microwaves*, and *Soviet Works on Nuclear Spectroscopy; a bibliographic index*, 1917-1960. M.R.W.

N66-21256# Polish Academy of Sciences, Warsaw.
MEASUREMENT OF THE RATIO OF SLOW TO FAST COMPONENTS OF SCINTILLATION IN STILBENE IN A WIDE RANGE OF dE/dx [POMIAR STOSUNKU SKLADOWEJ WOLNEJ DO SKLADOWEJ SZYBKIEJ SCYNTYLACJI STILBENU W FUNKCJI dE/dx]
Pszona Stanislaw Sep. 1965 14 p refs
(Rept.-653/IA/D) CFSTI: HC $1.00/MF $0.50

Report describes the method of measurement of the relative ratio of slow to fast components of scintillation in organic scintillators, as a function of dE/dx of incident particles. The results for stilbene are presented. Author

N66-21264# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
PAPERS PRESENTED AT THE 51st NATIONAL CONGRESS OF THE ITALIAN PHYSICAL SOCIETY, BOLOGNA, 5–10 NOVEMBER 1965 [COMUNICAZIONI PRESENTATE DAI LABORATORI DI FISICA AL 51st CONGREESO NAZIONALE DI FISICA BOLOGNA, 5–10 NOVEMBRE 1965]
30 Oct. 1965 53 p refs In ITALIAN; ENGLISH summary
(ISS-65/40) CFSTI: HC $3.00/MF $0.50

The papers deal with the following subjects: (1) some observations about the interpretation of the measurements of the binding energies in the reactions (e, e'p) and (p, 2p); (2) angular distribution of protons in C^{12} in the reaction (e, e'p) using incident electrons with energy between 550 and 700 MeV; (3) consequences of the inelastic unitarity condition in the eigenstates of the total angular momentum; and (4) applications of unitarity conditions to the calculation of the absorptions in all the partial waves in the nucleon–nucleon scattering. Author

N66-21326# Pennsylvania Univ., Philadelphia. Dept. of Physics.
THERMODYNAMIC PROPERTIES OF SPIN IMPURITIES IN HEISENBERG FERROMAGNETS
Daniel Hone, Herbert Callen, and Laurence R. Walker (Bell Telephone Labs., Murray Hill, N. J.) Nov. 1965 51 p refs Prepared in cooperation with Bell Telephone Labs.
(Contract Nonr-551(36))
(TR-28; AD-624721) CFSTI: HC $3.00/MF $0.50

Thermodynamic properties of an isolated spin impurity in a Heisenberg ferromagnet are calculated as functions of the magnitude of the impurity spin and of the strength of its exchange coupling to the host spins. The magnetization of the impurity, the energy and weight of its s-state localized mode (when such exists), and the shape of the local spectral weight function are all obtained as functions of temperature. Author (TAB

N66-21333# Osterreichische Studiengesellschaft fur Atomenergy G.m.b.H., Seibersdorf (Austria). Reaktorzentrum.
INVESTIGATION OF THE PARITY MIXTURE IN EXCITED NUCLEAR STATES BY MEASURING THE BETA-GAMMA ANGLE CORRELATION [UNTERSUCHUNG DER PARITATSMISCHUNG IN ANGEREGTEN KERNZUSTANDEN DURCH MESSUNG DER BETA-GAMMA WINKELKORRELATION]
F. Dydak and W. Woda 1965 15 p refs In GERMAN Submitted for Publication
(SGAE-PH-36/1965) CFSTI: HC $1.00/MF $0.50

The γ transfer in an excited nucleus with a small impurity of opposite parity was measured by two β and two γ detectors at 0° and 180° for a Co^{60} source. The time resolved coincidence spectrum produced 4 superimposed peaks on the coincidence background. Statistical evaluation of the spectrum established the asymmetry factor A as 0.003 at a statistical error A of similar value. Transl. by G.G.

N66-21339# Weizmann Inst. of Science, Rehovoth (Israel).
THEORY OF SHIFTS OF VIBRATION-ROTATION LINES OF DIATOMIC MOLECULES IN NOBLE GAS MATRICES. INTERMOLECULAR FORCES IN CRYSTALS Technical Note No. 2
H. Friedmann and S. Kimel Jul. 1965 63 p refs
(Contract AF 61(052)-838)
(AFCRL-65-783; AD-627042) CFSTI: HC $3.00/MF $0.7

It is shown that the observed shift of infrared lines of diatomic molecules trapped in noble gas crystals can be considered to be made up of a vibrational shift of the band center with a superimposed rotational shift dependent on the rotational quantum number J. These shifts were studied by means of a detailed analysis of the molecular motion. Shifts of HCl, DCl, HBr, and CO in Ar, Kr, and Xe matrices were obtained. Rotational shifts are interpreted by assuming that the trapped molecule is free to rotate about a point which does not coincide with the molecular center of mass. The resulting coupling between the rotational motion of the molecule and its constrained translational motion in the lattice is treated as a perturbation. The relation between this theory and the crystal field theory is discussed. TAB

N66-21427# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MODEL OF THE QUANTUM THEORY OF A FIELD WITH n FIXED FERMIONS

V. A. Gorodtsov 12 Oct. 1965 12 p refs Transl. into ENGLISH from Fizika. Astron. (Moscow), no. 3, 1963 p 75–80 (FTD-TT-65-929/1+4; AD-622354) CFSTI: HC $1.00/MF $0.50

Consideration is given to a model of the quantum theory of a field with n fixed fermions. In this model it is assumed that nucleons (fermions) are exchanged with mesons (bosons) of the mass μ without giving off anything, for example, the nucleons are considered to be infinitely heavy ($M \to \infty$). According to this principle there are no antinucleons and the number of nucleons is constant. The nucleons appear only as fixed sources of a quantum boson field. C.T.C.

N66-21501# Naval Radiological Defense Lab., San Francisco, Calif.

DOSE RATE AND SPECTRAL MEASUREMENTS FROM PULSED X-RAY GENERATORS

Eugene Tochilin and Norman Goldstein 3 Dec. 1965 29 p refs (USNRDL-TR-939; DASA-1703; AD-627567) CFSTI: HC $2.00/MF $0.50

Typical X-ray spectra from high intensity pulsed X-ray sources were determined by means of an equivalent constant voltage accelerator. The photon energy spectrum for the forward X-ray beam was measured with various X-ray target thicknesses at accelerator voltages of 1.0, 1.5 and 2.0 Mv. X-ray spectra were also obtained from a reflection X-ray target at angles of 7° and 45° with respect to the X-ray beam at applied potentials of 0.55, 1.0 and 2.0 Mv. The dose rate dependence of thermoluminescent LiF, silver-activated phosphate glass, and dosimetry film was investigated over a range of dose rates extending from 10^4 to 10^{11} rad/sec with three separate flash X-ray systems. Author (TAB)

N66-21604# European Organization for Nuclear Research, Geneva (Switzerland).

BEAM STACKING AT HIGH VALUES OF $\Gamma = \sin \phi_s$

E. Keil and A. Nakach (Centre d'Etudes Nucl., Saclay, France) 1966 35 p refs *Its* Rept.-66/255/10 (CERN-66-9)

The process of accumulating a beam in a storage ring by means of radio-frequency stacking at values of $\Gamma = \sin \phi$ between 0.5 and 0.84 is discussed. Results of statistical studies on a computer at these values of Γ are presented. They indicate that such stacking processes can be done with efficiencies well above 50% for stacks consisting of 100 or more pulses. Author

N66-21689*# National Aeronautics and Space Administration, Washington, D. C.

ROTATIONAL RELAXATION OF DIATOMIC MOLECULES [VRASHCHATEL'NAYA RELAKSATSIYA DVUKHATOMNYKH MOLEKUL]

Ye. Ye. Nikitin Feb. 1966 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Fiz. Khim. (Moscow), v. 161, no. 3, 1965 p 637–640 (NASA-TT-F-10007) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Relaxation equations for the rotational distribution function of diatomic molecules, colliding with an atom or electron under the conditions $\omega_j \tau \leq 1$ (ω_j=angular frequency; τ=collision time), are derived. A typical application to the rotational relaxation of molecules, in a thermal reservoir of light particles and taking the conservation of the Boltzmann distribution into consideration, is given for the case of inelastic excitation of molecular rotation in N_2, H_2, and I_2 in an atmosphere of helium. Author

N66-21758# Cornell Univ., Ithaca, N. Y. Lab. of Nuclear Studies.

[DEVELOPMENT AND USE OF A 2.2 GeV SYNCHROTRON] Final Report, 1 Feb. 1956–31 Jul. 1964

Robert R. Wilson [1964] 25 p refs (Contract Nonr-401(26)) (AD-627324) CFSTI: HC $1.00/MF $0.50

The synchrotron was modified to increase the operating energy from 1.3 Gev to a design energy of 2.2 Gev. At the same time a proposal was generated for the design and construction of a 10 Gev electron synchrotron. The modification of the 1.3 Gev synchrotron was conceived in July, 1962, and the major design features were completed by April 1963. Construction progressed during the last half of 1963, and on January 20, 1964, the 1.3 Gev machine was turned off and assembly and modification was begun. A beam was first obtained in the modified machine on April 28, 1964, just a little over three months after tear-down and assembly was begun. The next month was used in making final modifications and adjustments. TAB

N66-21789# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

ENERGY LEVELS OF Be^8 PRODUCED IN THE $B^{11}/n, \alpha/Li^8 \to Be^8$ PROCESS [POZIOMY Be^8 WYBUDZONE W PROCESIE $B^{11}, \alpha/Li^8 \to Be^8$]

M. Jaskola, L. Natanson, W. Osakiewicz, and J. Turkiewicz Sep. 1965 11 p refs (INR-655/I/PL) CFSTI: HC $1.00/MF $0.50

The energy spectrum of α-particles from the disintegration of Be^8 was measured. The Be^8 nuclei were formed in the $B^{11}/n, \alpha/Li^8 \to Be^8$ process. Only one peak—at 2.9 MeV—appears in the spectrum. Author

N66-21857# European Atomic Energy Community, Brussels (Belgium).

HYDROGEN MOTION IN PRIMARY SOLUTIONS OF HYDROGEN IN SOME TRANSITION ELEMENTS

W. Kley, J. Peretti, R. Rubin, and G. Verdan Feb. 1966 56 p refs Presented at the Brookhaven Natl. Lab. Symp., Upton, N. Y., 20–22 Sep. 1965 (EUR-2734.e) CFSTI: HC $3.00/MF $0.50

The scattering of cold neutrons was measured from VH_x, NbH_x and PdH_x systems at low hydrogen concentrations. The difference of the normalized intensities of the hydrogen system and the pure host lattice, reveals the neutron scattering

distribution of the hydrogen probe in the host lattice. Those intensity distributions show the expected high energy local modes of the hydrogen impurity well above the maximum frequency of the host lattice. For VH_x and NbH_x in the α phase, also a low energy neutron distribution of a few MeV is observed, close to the energy of the impinging neutrons. A part of a certain distortion near the maximum host lattice frequency, in addition, the host lattice frequency distribution can be seen through the hydrogen band modes. For Nb, two pronounced peaks are found at energy transfers of 25.9 and 18.3 MeV. They agree reasonably well with recent calculations of the frequency distribution of Nb. Author

N66-21870# General Electric Co., Schenectady, N. Y. Research and Development Center.

ATOMIC DISPLACEMENTS IN ONE-DIMENSIONAL AND TWO-DIMENSIONAL DIFFUSION

Gert Ehrlich Oct. 1965 21 p refs *Its* Rept.-65-C-039
(Contract AF 49(638)-1362)
(AFOSR-65-2769; AD-628016) CFSTI: HC $1.00/MF $0.50

The statistics of surface diffusion phenomena are developed for the conditions appropriate to measurements in the ion microscope. Examined in detail are: (1) the effect of boundaries (lattice steps on the mean square displacement in a random walk; (2) the probability density for distances traversed in a two-dimensional walk along nonorthogonal surface channels; and (3) the distribution of distances for random walks in which the number of jumps is subject to fluctuation, as it is in real systems. Both reflecting and adsorbing boundaries are found to diminish the mean square displacement in the same fashion. The effect of nonorthogonality, and even more so of fluctuations, is to enhance the frequency of small displacements when compared with a Rayleigh distribution. Author (TAB)

N66-21933# California Univ., Livermore. Lawrence Radiation Lab.

PLANE WAVE—A COMPUTER PROGRAM TO FIND IONIZATION CROSS SECTIONS

J. Dennis Lawrence 14 Sep. 1965 57 p refs
(Contract W-7405-ENG-48)
(UCRL-14402-T) CFSTI: HC $3.00/MF $0.75

In connection with the bombardment of elements by particles, it was desired to compute ionization cross sections of the various electronic shells. A numerical method for doing this was developed, with error terms, and programmed for the Remington-Rand Univac Larc computer.
Author (NSA)

N66-21934# Brookhaven National Lab., Upton, N. Y.

LEPTONIC DECAY OF NEUTRAL KAON $K_2^0 \rightarrow \pi^+\pi^-\pi^0$ DECAY

P. Guidoni, V. Barnes, H. W. J. Foelsche, T. Ferbel, A. Firestone (Yale Univ.) et al [1965] 13 p refs Presented at the Weak Interactions Conf., Argonne, Ill., 25-27 Oct. 1965 Prepared jointly with Yale Univ.
(Contract AT(30-2)-GEN-16)
(BNL-9613; A-138; CONF-651043-1) CFSTI: HC $1.00/MF $0.50

Various aspects of the $K_2^0 \rightarrow \pi^+\pi^-\pi^0$ decay are discussed. The branching ratio for the charged three-pion decay is discussed. To investigate the T_0 (kinetic energy of the π^0 in cms) dependence of the matrix element squared, a division by a phase-space factor and a correction for resolution broadening especially for the extreme bins was made. NSA

N66-21937# California Univ., Berkeley. Lawrence Radiation Lab.

INELASTIC π^-p INTERACTIONS AT 3.3 BeV/c AND 3.9 BeV/c

Thomas G. Schumann (Thesis) Jul. 1965 113 p refs
(Contract W-7405-ENG-48)
(UCRL-11942) CFSTI: HC $4.00/MF $0.75

The results of an investigation of final states with four or more particles, at 3.3 Bev/c and 3.9 Bev/c in liquid hydrogen, are presented. Several well-known multipion and pion-nucleon resonances are produced in the final state. In addition, evidence is presented for the existence of two new π-nucleon resonances. One has a mass of 2.65 Bev, charge +1 and decays into several channels with a nucleon and two or three pions; the other has a mass of 1.71 Bev, charge +2 and decays into $\pi^+\pi^0p$. Comparison of these enhancements with structure in the πp (with mass of 2.65 Bev) and π^-p (with mass of 1.7 Bev) total cross-sections is made. Author (NSA)

N66-21938# California Univ., Berkeley. Lawrence Radiation Lab.

MEASUREMENT OF THE N^{*-}–N^{*++} MASS DIFFERENCE

Sedong Kim (Ph.D. Thesis) Jul. 1965 66 p refs
(Contract W-7405-ENG-48)
(UCRL-16189) CFSTI: HC $3.00/MF $0.75

A measurement of the mass and width difference between N^{*-} ($I_z=-3/2$) and N^{*++} ($I_z=+3/2$) is described, where N^* is the pion-nucleon p-wave resonance of spin and isotropic spin 3/2 and mass approximately 1240 Mev. The resonances were produced in the inelastic reactions $n\,n \rightarrow p\,n\,\pi^-$ and $p\,p \rightarrow n\,p\,\pi^+$, which are known to proceed almost entirely via N^{*-} and N^{*++} production, respectively, in the observed energy region of a few Bev. The masses and widths of N^{*-} and N^{*++} were obtained from their respective effective mass distributions. In fitting the data for the masses two different formulas were used; (a) the OPE (one-pion-exchange) formula and (b) the resonance formula, with constant matrix element, which goes according to the phase space. Because the above inelastic reactions are known to be dominated by OPE, the values obtained with the OPE formula are taken to be the best estimate of the resonance parameters. This gives a mass difference of $\delta\omega_0=N^{*-}-N^{*++}=7.9 \pm 6.8$ Mev and a width difference of $\delta\Gamma_0=25 \pm 23$ Mev. This result agrees with the predictions based on the SU(3) and SU(6) symmetry schemes and various dynamical theories. Author (NSA)

N66-21942# Virginia Polytechnic Inst., Blacksburg. Dept. of Physics.

THE MEASUREMENT OF NEUTRON DIFFUSION PARAMETERS IN HEAVY AND LIGHT WATER CONCENTRATIONS BY THE PULSED NEUTRON TECHNIQUE Quarterly Progress Report, Dec. 1964–Feb. 1965

Harold Gwen Jones (Ph.D. Thesis) Jun. 1965 59 p refs
(Contract AT(40-1)-2686)
(TID-21851) CFSTI: HC $3.00/MF $0.75

Neutron diffusion parameter measurements have been made at 21°C in 0, 20, 50, 80, and 100 percent concentrations of heavy and light water. Pulsed neutron techniques were used with a 250-kv Cockcroft-Walton accelerator as the pulsed source. The range of bucklings used was from 0.0 to 0.70 cm^{-2}. The values for the diffusion coefficient, D_0, the diffusion cooling coefficient, C; and the transport mean free path, λ were determined from the expansion of the decay constant to second order using an iteration procedure. The values of D_0, C, and λ are tabulated. Author

N66-21944# California Univ., Berkeley. Lawrence Radiation Lab.
MOLECULAR-BEAM STUDIES OF LANTHANUM MONOXIDE
Robert Michael Walsh (Ph.D. Thesis) Apr. 1965 42 p refs
(Contract W-7405-ENG-48)
(UCRL-11927) CFSTI: HC $2.00/MF $0.50

A new method was devised to establish the ground state of a high-temperature molecule by examination of the fluorescent spectrum of a molecular beam. An apparatus to form a molecular beam was constructed and a beam of lanthanum monoxide generated. The new method was successfully applied to establish the ground state as that designated as $X^4\Sigma$ in earlier spectral studies. The suitability of the LaO beam for use in the determination of the radiative lifetime by means of the phase-delay technique is discussed, together with a consideration of the light sources that might be used for such a measurement. The lifetime of the $B^2\Sigma$ state of LaO was estimated to be on the order of 10^{-7} sec. The known electronic spectra of LaO, ScO, and YO are discussed and an extension of the molecular-beam fluorescence technique is proposed to settle a problem of the location of an excited state. Author (NSA)

N66-21950# Institute for Mathematical Sciences, Madras (India).
MASS SUM RULES, SYMMETRIES AND DISPERSION RELATIONS
K. Venkatesan [1964] 10 p refs *Its* Seminar Lecture No. 20
(NP-15638)

Currents involving fields corresponding to strongly interacting particles are considered, for cases in which these currents appear in weak interaction processes. Within the framework of SU_3 symmetry, these considerations are used to derive mass sum rules and dispersion relations. NSA

N66-21951# Brookhaven National Lab., Upton, N. Y.
STRONG INTERACTIONS AT HIGH ENERGY
S. J. Lindenbaum [1965] 71 p refs
(Contract AT(30-2)-GEN-16)
(BNL-9652; CONF-650945-3) CFSTI: HC $3.00/MF $0.75

A review is presented of attempts at interpretation of high-energy strong-interaction data, in terms of axiomatic field theory and the forward dispersion relations that follow therefrom. NSA

N66-21954# Comision Nacional de Investigaciones Especiales, Buenos Aires (Argentina).
INTRODUCTORY COURSE ON MOTION OF CHARGED PARTICLES IN STATIC MAGNETIC FIELDS
J. G. Roederer Jul. 1964 41 p refs
(CNIE-PE-1)

Several topics are reviewed, including motion of particles in static homogeneous magnetic fields, motion in homogeneous fields with external forces, motion in inhomogeneous fields having various geometries, adiabatic invariants, flux relations for trapped particles in a stationary state, effects of scattering on trapped-particle flux, geometric characteristics and particle trapping in pure dipole magnetic fields, and particle trapping in perturbed dipole fields. The effects of temporal field variations are touched upon lightly. NSA

N66-21956# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
STATISTICAL ANALYSIS OF 17 GeV PION INTERACTION WITH HEAVY EMULSION NUCLEI [STATISTICHESKII ANALIZ VZAIMODEISTVIYA π^--MEZONOV S ENERGIEI 17 GeV S TYAZHELYMI YADRAMI FOTOEMULSII]
I. Z. Artykov, V. S. Bsrashenkov, and S. M. Eliseev 1965 10 p refs In RUSSIAN Submitted for Publication
(JINR-P-2373)

The results of calculations of intranuclear cascades made by the Monte Carlo method are compared with experiment. Experiment and theory agree. Author (NSA)

N66-21957# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria).
PROMPT AND DELAYED GAMMA RAYS IN NUCLEAR FISSION [DIE PROMPTE UND VERZOEGERTE GAMMA-STRAHLUNG BEI DER KERNSPALTUNG]
Hans Peter Axmann and Peter Weinzierl 1965 23 p refs In GERMAN Submitted for Publication
(SGAE-PH-29/1965)

A survey is given of the experimental investigations of γ radiations in nuclear fission from its discovery up to the present. The results were discussed and their significance was considered. A new type of nuclear spectroscopy was reported. Author (NSA)

N66-21960# Western Reserve Univ., Cleveland, Ohio.
RECOIL-FREE SCATTERING OF GAMMA-RAYS . Final Technical Report, Mar. 1, 1962–Jun. 30, 1965
John K. Major, G. Michael Kalvius, and Berol L. Robinson [1965] 6 p refs
(Contract AT(11-1)-1146)
(TID-22384) CFSTI: HC $1.00/MF $0.50

During this period, instrumentation for experiments on the Mössbauer effect was begun and completed, and recoil-free scattering studied. Brief discussions of work on instrumentation, resonant scattering, and nonresonant scattering are presented. NSA

N66-21965# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
REVIEW OF EXPERIMENTAL DETERMINATIONS OF NEUTRON SPECTRA
R. E. Slovacek 17 Nov. 1965 20 p refs Presented at the Tech. Group for Reactor Phys. Meeting at the Meeting of the Am. Nucl. Soc., Washington, 17 Nov. 1965 Submitted for Publication
(Contract W-31-109-ENG-52)
(CONF-651101-43) CFSTI: HC $1.00/MF $0.50

A review is presented of several integral and differential experimental methods for measuring neutron spectra below 10 ev in various media. The advantages, disadvantages, and regimes of usefulness of the different methods are noted. 18 references. NSA

N66-21967# Oak Ridge National Lab., Tenn.
LONG-RANGE α-PARTICLES OF RADIUM C
K. Phillipp and K. Donat [1965] 10 p refs Transl. into ENGLISH from Z. Physik (Berlin), v. 52, 1928 p 759–766
(ORNL-TR-696)

The investigation of the long-range alpha-particles of RaC, according to the Wilson cloud method, was continued

in order to be able to make more accurate statements on the range and frequency of these rays. A movie camera which had been equipped for stereoscopic single frames was used in place of the still camera previously utilized. Author (NSA)

N66-21971# Brookhaven National Lab., Upton, N. Y.
HYPERON NON-LEPTONIC DECAYS
N. P. Samios [1965] 26 p refs Presented at the Intern. Conf. on Weak Interactions, Argonne, Ill., 25-27 Oct. 1965
(Contract AT(30-2)-GEN-16)
(BNL-9666; CONF-651043-2) CFSTI: HC $2.00/MF $0.50

A review of non-leptonic decay of hyperons Λ^0, Σ^+, Σ^-, Σ^0, Ξ^-, Ξ^0, and Ω^- is presented. In particular, the $\Delta I = 1/2$ rule and $|\Delta S| \leq 1$ theories are discussed. NSA

N66-21979# Illinois Univ., Urbana. Dept. of Physics.
PERIPHERAL PRODUCTION AND DECAY CORRELATIONS OF RESONANCES
J. D. Jackson [1964] 66 p refs Submitted for Publication
(Contract AT(11-1)-182)
(TID-21316) CFSTI: HC $3.00/MF $0.75

Peripheral reactions at incident momenta of a few Bev/c involving the production of one or more unstable particles or resonances are discussed. The prominence of quasi-two-body channels is established, and the peripheral nature of the production process is emphasized. The need for strong form factors in the one-meson-exchange model is noted. The search for ways to test the peripheral model independently of the momentum-transfer distributions leads to consideration of angular correlations of the decay products of the resonances. It is deduced that there is strong experimental evidence for the exchange of definite angular momenta and isospin in the t-channel, most readily interpreted as the exchange of pseudoscalar and vector mesons. Absorption of the lower partial waves due to competing processes is discussed as a mechanism for producing collimation is then presented and applied with considerable success to specific reactions yielding decay correlations, angular dependences of production, and absolute cross sections in agreement with experiment. Some failures and limitations of the model are discussed, as well as prospects for improvement. Author (NSA)

N66-21980# California Univ., Berkeley. Lawrence Radiation Lab.
PHOTOIONIZATION OF ALKALI-METAL VAPORS
Yuan-Tseh Lee (Ph.D. Thesis) Jun. 1965 78 p refs
(Contract W-7405-ENG-48)
(UCRL-16093) CFSTI: HC $3.00/MF $0.75

The vapors of potassium, rubidium, and cesium were photoionized with light absorbed in the discrete region of the atomic spectrum. The energy threshold for the ionization process was determined and the ions produced identified by mobility measurements. The data give lower limits for the dissociation energies of K_2^+, Rb_2^+, and Cs_2^+. Each of these molecular ions has a bond energy approximately 50% greater than that of the corresponding neutral molecule. In addition, lower limits for the electron affinities of the alkali atoms and values for the mobilities of Rb^+, Rb_2^+, Cs^+, and Cs_2^+ in their present vapor are given. Author (NSA)

N66-21987# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Institut.
APPLICATIONS OF THE MOESSBAUER EFFECT AND THE PERTURBED ANGULAR CORRELATION METHOD IN NUCLEAR PHYSICS [PRIMENENIYA EFFEKTA MESSBAUERA I VOZMUSHCHENNYKH UGLOVYKH KORRELYATSII V YADERNOI FIZIKE]
V. A. Klyucharev 13 Feb. 1965 22 p refs In RUSSIAN
(NP-15603)

The nuclear cascade general representation allows one to compare the possibilities of the Mossbauer experiments and the angular correlation method and to point out the features of the information obtainable with these methods. It is shown that the higher energy resolution connected with the perturbed angular correlation method allows one to measure the short-lived nuclear states splitting, even if the distance between m-substates is less than the natural line-width. Experimental results on magnetic dipole and electric quadrupole moments of the short-lived excited nuclear states are summarized. Nuclear information perturbations due to interactions between the nuclear spin and the extra-nuclear fields and the possible experiments on the interference effects (such as "reorientation" in Coulomb exitation) are discussed. Author (NSA)

N66-21993# International Centre for Theoretical Physics, Trieste (Italy).
ON THE SPIN EXTENSION OF UNITARY GROUPS
T. S. Santhanam 11 Nov. 1965 6 p refs Submitted for Publication
(IC/65/81)

It is shown that since the spin extension of unitary groups puts a restriction in addition to the one usually faced with baryonic number, the SU(4) group would be interesting only if particles with fractional quantum numbers would be observed, using a simple model in which the basic objects are fermions. Author (NSA)

N66-21994# Commissariat a l'Energie Atomique, Cadarache (France). Departement des Etudes de Piles.
NEUTRON DENSITY DECAY CONSTANT IN A NON-MULTIPLYING LATTICE OF FINITE SIZE [CONSTANTE DE DECROISSANCE DE LA DENSITE NEUTRONIQUE DANS UN RESEAU NON-MULTIPLICATEUR DE DIMENSIONS FINIES]
Valentine-C. Deniz Jul. 1965 45 p refs In FRENCH
(CEA-R-2712; SEC/Ca-2)

A general theory, using the integral transport method, is presented for obtaining the neutron density decay constant in a finite non-multiplying lattice. The theory is applied to obtain the expression for the diffusion coefficient. The case of a homogeneous medium with 1/v absorption and of finite size in all directions is treated in detail, assuming an isotropic scattering law. The decay constant is obtained up to the B^6 term. The expressions for the diffusion coefficient and for the diffusion cooling coefficient are the same as those obtained for a slab geometry by NELKIN, using the expansion in spherical harmonics of the Fourier transform in the spatial variable. Furthermore, explicit forms are obtained for the flux and the current. It is shown that the deviation of the actual flux from a Maxwellian is the flux generated in the medium, extended to infinity and deprived of its absorbing power, by various sources, each of which has a zero integral over all velocities. The study of the current permits the generalization of Fick's law. An independent integral method, valid for homogeneous media, is also presented. Author (NSA)

N66-21995# International Centre for Theoretical Physics, Trieste (Italy).

ON THE COUPLING OF NON-COMPACT GROUP REPRESENTATIONS

Abdus Salam and J. Strathdee 10 Nov. 1965 16 p refs Submitted for Publication

(IC/65/79)

Elementary particle "tower" representations in U(ν, ν) and GL(ν, C) are shown, and the decomposition of several particular U(ν, ν) representations is carried out. The trilinear coupling of representations is investigated. Coefficients are computed for the example of trilinear coupling of two baryon-like towers to a meson-like tower. NSA

N66-21998# Utrecht State Univ. (Netherlands).

EXPERIMENTAL AND THEORETICAL INVESTIGATIONS ON LIGHT NUCLEI

Peter Willem Maria Glaudemans (Ph.D. Thesis) 1964 96 p refs Submitted for Publication

(NP-15647)

The shell model is used to investigate quantitatively the nuclei in the range ^{29}Si—^{40}Ca. An inert ^{28}Si core is assumed with a two-particle interaction of the outer nucleons in the $2s_{1/2}$ and $1d_{3/2}$ shells. Mixing of all possible configurations in these shells is taken into account. The interaction matrix elements are reduced to linear expressions in 17 parameters (i.e., 15 two-particle interactions and 2 binding energies to the core). The methods used are discussed. The numerical results are presented. The values of the two-particle interactions in the $2s_{1/2}$ $1d_{3/2}$ shell and the binding energies to the ^{28}Si core of $2s_{1/2}$ and $1d_{3/2}$ particles are derived from experimental level energies. The calculated energies, spins and configurations of about 400 levels are listed. With the nuclear wave functions obtained, the spectroscopic factors for stripping reactions are calculated and, where possible, compared with the experimental data. The gamma-ray spectra at six ^{23}Na(p,γ)^{24}Mg resonances in the E_p=300–750 keV region were investigated with scintillation spectrometers. From single spectra, coincidence spectra and sum-coincidence spectra the gamma-ray branchings of the resonance levels and of eighteen lower ^{24}Mg levels were obtained. At most resonances a 1.63 MeV gamma ray was observed, from which the relative intensity of the ^{23}Na(p,α_1)^{20}Ne decay could be found. Thick target gamma-ray yields were measured from which the resonance strengths were obtained. Gamma-ray angular distributions and γ–γ angular correlations were measured at six ^{23}Na(p,γ)^{24}Mg resonances in the E_p=300–800 keV region. Analysis of these data with an electronic computer yields spin and parity assignments: J^π=2(+), 1(+), 2–, 3, 3(+), and 2+ to the resonances at E_p=308, 511, 591, 676, 738, and 743 keV, respectively. The even parities in brackets are regarded as very probable. In each of these cases odd parity would imply the existence of an M2 transition with a strength of at least 0.5 Weisskopf units. The same measurements give J^π=2+ for the ^{24}Mg level at E_x=7.35 MeV. Single spectra and γ–γ coincidence spectra measured at the weak E_p=251 and 374 keV resonances yield the resonance branching ratios. The gamma-ray yield from the reaction ^{32}S(p,γ)^{34}Cl was measured in the range E_p=300–1300 keV. Twenty-two resonances were observed with resonance strengths $(2J_r+1)$ $\Gamma_p\Gamma\gamma/\Gamma$ between 0.01 and 1.0 eV. From single and coincidence spectra with scintillation spectrometers the gamma-ray branchings of the resonance levels and of nineteen lower levels in ^{34}Cl were obtained. The decay of the levels of ^{34}Cl below 2.5 Mev is compared with spin predictions from the shell model. NSA

N66-22002# California Univ., Berkeley. Lawrence Radiation Lab.

ENERGY DEPENDENCE OF THE POLARIZATION IN p–^{16}O ELASTIC SCATTERING BETWEEN 21 AND 53 MeV

E. T. Boschitz, M. Chabre, H. E. Conzett, and R. J. Slobodrian Aug. 1965 8 p refs Presented at Intern. Conf. on Polarization Phenomena of Nucleons, Karlsruhe, W. Germany, 6–10 Sep. 1965

(Contract W-7405-ENG-48)

(CONF-650928-13; UCRL-16217) CFSTI: HC $1.00/MF $0.50

The polarization resulting from the elastic scattering of 21- to 53-Mev polarized proton beams by ^{16}O is measured at seven discrete energies. The differential cross section is also measured at two of these energies. It is concluded that the optical model fits the experimental data fairly well for the proton–^{16}O elastic scattering in this energy range. NSA

N66-22004# Akademiya Nauk SSSR, Novosibirsk. Institut Yadernoi Fiziki.

SOME SELECTION RULES FOR THE ANNIHILATION OF POLARIZED FERMIONS [NEKOTORYE ZAPRETY DLYA ANNIGILYATSII POLYARIZOVANNYKH FERMIONOV]

I. B. Khriplovich 11 Jun. 1965 6 p refs In RUSSIAN; ENGLISH summary

(NP-15602)

Some selection rules are given for pseudoscalar meson production in the annihilation of transversely polarized electrons and positrons. The invariance under the reflection of a space axis and the chirality conservation are used.

Author (NSA)

N66-22007# Oak Ridge National Lab., Tenn.

THE EFFECT OF IONIZING RADIATION ON COALESCENCE RATES IN LIQUID–LIQUID SYSTEMS

Conrad V. Chester (Ph.D. Thesis—Tennessee Univ.) Dec. 1965 105 p refs

(Contract W-7405-ENG-26)

(ORNL-TM-1283) CFSTI: HC $4.00/MF $0.75

An investigation of the effect of irradiation by alpha particles and fission fragments on the coalescence times of aqueous drops with a planar liquid-liquid interface was carried out. It was found that, on impact of the drop on the interface, coalescence probability was roughly proportional to the particles flux at the drop surface; as flux increased to 240 fission fragments or 570 alpha particles crossing the drop surface per second (extrapolated), the coalescence probability approached unity. The effect of irradiation was manifested only at the moment of impact, and was not affected by temperature, pressure, or composition of the organic phase, whether n-hexane, n-heptane, or n-decane. The systems studied were very pure, as very minute traces of surface-active contaminants stopped the effect of irradiation. A mechanism which is not at variance with any of the experimental observations is proposed. In this mechanism, it is postulated that free radicals produced in the wake of a particle crossing the interface at a very low grazing angle (less than 1°) can react with nearby molecules of the other phase to produce molecules which have high surface activity, e.g., hexyl alcohol. The local decrease of interfacial tension can start a ripple in the interface which can be amplified by the shear forces at impact to initiate coalescence. Author (NSA)

N66-22010# Vanderbilt Univ., Nashville, Tenn.
THE E2 INTERNAL-CONVERSION PROCESS IN Gd-152 AND Gd-154 AND THE BETA-GAMMA DIRECTIONAL CORRELATION IN THE DECAY OF Eu-154
Edward Francis Zganjar (Ph.D. Thesis) Jan. 1966 164 p refs (Contract AT-40-1-GEN-33)
(TID-22393) CFSTI: HC $5.00/MF $1.00

A description of the internal conversion process is presented. The difference between the "static" and "dynamic" effects of nuclear size was pointed out. Theoretical estimates based upon the no-penetration model of Rose and the surface current model of Sliv and Band indicate that the conversion process of E2 transitions is quite insensitive to the static and dynamic effects of nuclear size. Penetration effects are expected to be important only if the transition is highly retarded. Evidence was presented, however, which showed that the E2 conversion process in deformed nuclei did not agree with theoretical predictions. Angular correlations and particle parameters were discussed. It was shown that the measurement of particle parameters can provide a more sensitive test of the conversion process than the conversion coefficient. The presently accepted theory of first-forbidden beta decay was described. It was shown that those transitions which deviate from the ξ-approximation are of greatest interest and that the 1855-kev 1FNU transition in ^{154}Eu was expected to fall into this category. The expressions for the shape, comparative half-life, and beta-gamma directional correlation, which represent corrections to the ξ-approximation for a $3^-(\beta)2^+(\gamma)0^+$ transition, were presented. The "cancellation" and "selection rule" effects were discussed and the distinction between "K-forbiddennes" and "j-forbiddennes" was set forth. Descriptions of the experimental apparatus, experimental procedures, and methods of data analysis were presented. Contained therein are discussions concerning the calibration of the lens spectrometer, the corrections for finite angle, and attenuation effects in directional correlations. Measurements of the K-, L-, and M'-particle parameters of the 123-kev, E2 transition in ^{154}Gd and the K-particle parameter of the 344-kev, E2 transition in ^{152}Gd are described. These nuclei lie at the edge of the deformed region where ^{152}Gd is just outside (spherical) and ^{154}Gd is inside (deformed). NSA

N66-22012# International Centre for Theoretical Physics, Trieste (Italy).
DEGENERATE REPRESENTATIONS OF COMPACT AND NON-COMPACT UNITARY GROUPS
R. Raczka Nov. 1965 14 p refs Submitted for Publication
(IC/65/80)

Degenerate representations of compact groups U(n) on domains of rank one are considered. Degenerate representations of non-compact groups U(p,q) acting in a Hilbert space of discrete basis is studied. The problem of maximal reduction of a number of commuting operators for a given higher symmetry group is solved. NSA

N66-22016# Brussels Univ. (Belgium). Science Faculty.
CONTRIBUTION TO THE STUDY OF HEAVY HYPERNUCLEI [CONTRIBUTION A L'ETUDE DES HYPERNOYAUX LOURDS]
J. Lemonne (Ph.D. Thesis) 1965 202 p refs In FRENCH; ENGLISH summary
(NP-15617)

Some general concepts relative to hypernuclei are introduced and a brief description is given of the experimental techniques used for their study. The history of the detection of heavy hyperfragments is traced and the principal experimental data leading to the detection of these hyperfragments are analyzed. The experimental results obtained in the present study on the interactions of K− mesons with emulsion nuclei are reported. The interaction of K− mesons at rest and in flight (50 to 400, 500, 1300, and 1500 Mev/c) are studied simultaneously. Some of the most important aspects of the mechanism for the production of heavy hypernuclei are studied. The relative contribution of cascade and nuclear evaporation processes to the transfer of momentum to the observable heavy hyperfragments is determined. The interactions of Λ^0 that can be deduced from the study of heavy hypernuclei are discussed. It is shown that the analysis of non-meson decays of heavy hypernuclei can furnish information on the charge dependence of the initial nucleon and on the cross section of the weak reaction $\Lambda^0+N\rightarrow N+N$. The results obtained are placed within the general framework of the study of heavy hypernuclei. NSA

N66-22019# Los Alamos Scientific Lab., N. Mex.
COMPUTATION OF FAST NEUTRON PENETRATION IN AIR BY THE "Sn METHOD" WITH SPECIAL EMPHASIS ON THE USE OF "MULTITABLE-MULTIGROUP CROSS SECTION SETS"
H. A. Sandmeier, G. E. Hansen, R. B. Lazarus, and R. J. Howerton (Lawrence Radiation Lab.) 17 Nov. 1965 66 p refs
(Contract W-7405-ENG-36)
(LA-3415) CFSTI: HC $3.00/MF $0.75

Much theoretical work was done earlier to represent the angular dependence in the scattering source term of the Boltzmann equation by means of Legendre or other series expansions. However, relatively little work has been done to feed this information into present day Sn codes. The Sn transport codes at LASL allow a representation of anisotropy in the scattering-source term by means of multitable cross section sets. A formalism is developed to generate these sets. The numerical evaluation of Sn cross section entries for these multitable sets was computerized. Deep penetration calculations (3000 meters) of high energy neutrons in homogeneous air are presented. These calculations used recently evaluated basic cross section data for nitrogen and oxygen from the LRL–LASL Library (Howerton tape). The variations in the neutron flux due to different approximations are discussed as are also the expected variations in the flux due to inaccuracies in cross section data. Author (NSA)

N66-22021# Gosudarstvennyi Fomitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'noi Fiziki.
CASIMIR OPERATORS FOR AN ORTHOGONAL AND SYMPLECTIC GROUP [OPERATORY KAYIMIRA DLYA ORTOGONAL'NOI I SIMPLEKTICHESKOI GRUPPY]
A. M. Perelomov and V. S. Popov 20 May 1965 36 p refs In RUSSIAN *Its* Rept.-352
(NP-15391)

Explicit expressions for the eigenvalues of invariant operators of arbitrary order (Casimir operators) in the case of orthogonal and symplectic group were obtained. Author (NSA)

N66-22023# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
BROKEN SYMMETRY (SU6) AND ELECTROMAGNETIC PROPERTIES OF BARYONS [MARYSHENNAYA SIMMETRIYA SU(6) I ELEKTROMAGNITNYE SVOISTVA BARIONOV]

Z. R. Babaev and V. S. Zamiralov 20 Oct. 1965 8 p refs In RUSSIAN
(JINR-P-2401)

The relations between magnetic moments and the amplitudes of magnetic transitions in the SU(6) symmetry are found, the corrections owing to the introduction of the medium-strong interaction being taken into account. The formulas obtained are compared with experimental data.

Author (NSA)

N66-22024# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'noi Fiziki.

AT WHAT DISTANCES DOES INTERACTION AT HIGH ENERGIES OCCUR? [NA KAKIKH RASTOYANIAKH PROISKHODIT VZAIMODEISTVIE PRI VYSOKICH ENERGIYAKH?]

V. N. Gribov, B. L. Ioffe, and I. Ya. Pomeranchuk 12 May 1965 18 p refs In RUSSIAN
(NP-15600)

The question of what distances are essential for elastic and inelastic scattering at high energies may be resolved by investigating experimentally the radiation of soft quanta accompanying the given scattering process. In this case if the region of applicability of usual formulas of accompanying radiation proves to decrease with the growth of the energy of incident particle ϵ, it means that the effective longitudinal distances, essential for interaction at high energies, grow with the growth of ϵ.

Author (NSA)

N66-22035# California Univ., Berkeley. Lawrence Radiation Lab.

K^-p CHARGE EXCHANGE SCATTERING FROM 1200 TO 1700 MeV/c

Charles Gordon Wohl (Ph.D. Thesis) 13 Jul. 1965 67 p refs
(Contract W-7405-ENG-48)
(UCRL-16288) CFSTI: HC $3.00/MF $0.75

The 72-inch hydrogen bubble chamber was exposed to a beam of mesons (K^-) having laboratory momenta of 1.22, 1.42, 1.51, 1.60, and 1.70 BeV/c. The K^-p charge exchange scattering differential cross sections were measured. The cross sections are, from low to high momentum, 2.83 ±0.14, 190 ±0.12, 1.83 ±0.09, 1.93 ±0.13, and 1.66 ±0.10 mB. The differential cross sections are peaked at the ends ($\cos\theta = \pm 1$); there are two intermediate maxima. As the momentum increases, the peaking shifts rapidly from the backward to the forward direction. Though the forward (low momentum transfer) peaking at the higher momenta is considerable a peripheral mechanism is by itself insufficient to reproduce the angular distribution. The differential cross sections are fit to Legendre polynomial series. At 1.22 BeV/c, the series including $P_6(\cos\theta)$ is necessary and sufficient; at the higher momenta, $P_7(\cos\theta)$ is required. The $F_{7/2}$ and $G_{7/2}$ partial wave amplitudes are both present. At 1.60 and 1.70 BeV/c, the J=7/2 partial waves account for at least a third of the cross section. The behavior as a function of energy of some of the coefficients of the Legendre polynomial expansion suggests, though does not definitely establish, the existence of an $F_{7/2}$ $Y_1^*(2065)$. This has the quantum numbers of the recurrence of the $Y_1^*(1385)$ and belongs to the decuplet containing the $N_{3/2}^*(1920)$.

Author (NSA)

N66-22036# California Univ., Berkeley. Lawrence Radiation Lab.

Ke_4 DECAY AND THE DETERMINATION OF π-π SCATTERING PHASE SHIFTS

Alexander T. Maksymowicz (Ph.D. Thesis) 1 May 1965 93 p refs
(Contract W-7405-ENG-48)
(UCRL-16026) CFSTI: HC $3.00/MF $0.75

The study of correlations in K decays can give unique information of low energy π-π scattering. By using an appropriate system of energy and angle variables to describe the decao $K^+ \to \pi^+\pi^-e^+\nu$, a particularly simple set of angular correlations for this process is defined. It is shown that the measurement of these angular correlations at any fixed π-π cms energy allows a model-independent determination of the difference between the S- and P-wave π-π scattering shifts, $\delta_0 - \delta_1$, at that energy to be made. Information about the average value and sign of $\delta_0 - \delta_1$ can be obtained from a measurement of the same correlations averaged over the energy spectrum. Measurement of the average correlations is particularly suited to the testing of any model of low energy π-π scattering. Discussions are given of the model in which S-wave scattering is described by the Chew-Mandelstam effective range formula and the effects of the final state interaction between the pions by the relativistic Watson enhancement factor. If this model is adequate, the suggested measurements should yield a value for the S-wave scattering length in the I=0 state. By using unitary symmetry considerations to estimate the vector current contribution to the K_{e4} decay rate, it is shown that it is very small compared to that of the axial current and thus its neglect in the model calculation is justified. The effects of a possible violation of time-reversal invariance are investigated; it is found that, in general, it would greatly complicate the analysis. Author (NSA)

N66-22038# Atomics International, Canoga Park, Calif.

THE TRIX-1 CODE, AN IMPROVED ANALYTIC CALCULATION OF RESONANCE INTEGRALS

J. M. Otter 26 Jul. 1965 54 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-MEMO-11538) CFSTI: HC $3.00/MF $0.50

Trix-1 is a Fortran code which calculates multigroup, Doppler broadened effective resonance integrals and cross sections and their temperature coefficients for a heterogeneous or homogeneous resonance absorber. Using basic resonance parameters, geometry, and concentrations, the code combines resolved resonance, unresolved resonance, and 1/V and negative energy resonance calculations. The code is designed for convenient use in comparing theory and experiment, as well as in multigroup reactor calculations. The short running time makes the code desirable for use in survey calculations. The theory is based on the single level Breit-Wigner line shape with no overlapping of neighboring resonances. Analytic approximations based on the work of Chernick and Vernon and Goldstein and Cohen are used. Detailed descriptions of the theory are given. Situations in which the theory can be deficient are pointed out. The logical flow of the program is shown together with descriptions of the input and output formats. Sample cases are appended.

Author (NSA)

N66-22040# Bettis Atomic Power Lab., Pittsburgh, Pa.

TRANSPORT SYNTHESIS

James A. Davis and Stanley Kaplan Sep. 1965 15 p Presented at the Meeting of the Am. Nucl. Soc., Washington, D. C., Nov. 1965
(Contract AT(11-1)-GEN-14)
(WAPD-T-1949; CONF-651101-45) CFSTI: HC $1.00/MF $0.50

A Fortran program (Transy) is developed to obtain synthesized solutions to the S_2 or S_4 equations for a monoenergetic x–y problem. The Transy synthesis is based on the discrete ordinate method. The purpose of the synthesis is to investigate the feasibility of synthesizing solutions to high order approximations to the transport equation. NSA

N66-22042# Commissariat a l'Energie Atomique. Saclay (France). Centre d'Etudes Nucleaires.

STUDY OF HYPERON-ANTIHYPERON PRODUCTION IN ANTIPROTON-PROTON COLLISION AT 4 GeV/c [ETUDE DE LA PRODUCTION D'HYPERON ET D'ANTIHYPERON DANS LES COLLISIONS ANTIPROTON-PROTON A 4 GeV/c]

Daniel Revel (Ph.D. Thesis—Paris Univ.) 1965 78 p refs In FRENCH
(CEA-R-2798)

The results on hyperon–antihyperon production by 4 BeV/c antiprotons in hydrogen are presented. The aim of this work was the study, through the cross sections and the angular distributions, of production mechanisms of hyperon–antihyperon pairs and excited hyperons (or antihyperons). For most of the channels, these angular distributions show a strong forward peaking of the antihyperon in the center of mass of the interaction. This suggests that a peripheral-type mechanism is predominant in these processes. The results of some cross sections are compared with theoretical predictions according to SU_3 unitary symmetry. NSA

N66-22044# California Univ., Berkeley. Lawrence Radiation Lab.

SCATTERING OF 50.9 MeV ALPHA PARTICLES FROM Ne^{20} AND Ca^{40}

Arthur Springer (Ph.D. Thesis) 6 May 1965 131 p refs
(Contract W-7405-ENG-48)
(UCRL-11681) CFSTI: HC $4.00/MF $1.00

More than a dozen inelastic levels of both ^{20}Ne and ^{40}Ca were excited by inelastic scattering of 50.9 MeV alpha particles. Differential cross sections for these excitations were measured, and by analysis with the Austern and Blair model, one-step and two-step excitation processes were distinguished from each other. Spins, parities, and reduced transition probabilities were also extracted with the aid of this model. This information was then used to discuss the collective nuclear structure of ^{40}Ca, which is vibrational, and ^{20}Ne which has rotational bands based on both the ground state and octupole vibrations. Author (NSA)

N66-22045# California Univ., Berkeley. Lawrence Radiation Lab.

THE UV ABSORPTION SPECTRUM OF TRAPPED S_2

L. Brewer, G. D. Brabson, and B. Meyer Sep. 1964 23 p refs Submitted for Publication
(Contract W-7405-ENG-48)
(UCRL-10771) CFSTI: HC $1.00/MF $0.50

The uv absorption spectrum of trapped S_2 was studied in N_2, Ar, Kr and Xe matrices at 4° and 20°K. Up to 26 vibrational bands of the $v''=0$ progression of the $^3\Sigma_u^- \leftarrow {}^3\Sigma_g^-$ system were observed. In each of the matrices, the origin of the transition was shifted by an amount characteristic of the particular matrix; red shifts were observed for Xe, Kr and Ar, while N_2 yielded a blue shift. The vibrational spacing indicated distortion of the potential energy curve under the influence of the matrix field. The absorption bands were slightly shaded towards the blue and had a half width of about 150 cm^{-1}. At low v', doublet structure was observed. Author (NSA)

N66-22051# California Univ., Berkeley. Lawrence Radiation Lab.

INTERNAL CONVERSION ELECTRONS FROM PRIMARY FISSION FRAGMENTS

R. L. Watson, H. R. Bowman, S. G. Thompson, and J. O. Rasmussen May 1965 15 p Presented at the Intern. Conf. on the Internal Conversion Process, Nashville
(Contract W-7405-ENG-48)
(UCRL-16184; CONF-650525-7) CFSTI: HC $1.00/MF $0.50

The experimental facilities and techniques for measuring the energies of conversion electrons from primary fission fragments are discussed. Some results are given for the mass intervals (103–105) and (143–145) in which the heavy fragment is in the region of barium. NSA

N66-22056# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

A METHOD OF DETERMINATION OF THE Ω^--HYPERON PARITY [METOD OPREDELENIYA CHETNOSTI Ω^--GIPERONA]

S. M. Bilen'kii and R. M. Ryndin 8 Jul. 1965 6 p refs In RUSSIAN Submitted for Publication
(JINR-P-2258)

A method of determining the Ω^- hyperon parity is suggested. It is based on invariance under reflections in the reaction plane and requires a study of the reaction $K^- + p \rightarrow \Omega^- + (K^+ K_0)_{1280}$ on a polarized proton target. Author (NSA)

N66-22059# Maryland Univ., College Park. Dept. of Physics and Astronomy.

A PROGRAM TO CALCULATE 3-BODY DISTRIBUTIONS FOR A GENERAL MATRIX ELEMENT

G. B. Yodh Feb. 1965 47 p refs *Its* Tech. Rept.-442
(Contract AT(30-1)-2464)
(TID-21784) CFSTI: HC $2.00/MF $0.50

The three-body Lorentz-invariant matrix element is calculated, taking into account the effects of interference, angular momentum barrier terms, decay characteristics, and partial waves dominating the process. An IBM 7094 Fortran program is outlined whose purpose is to carry out the numerical calculations involved in this study. NSA

N66-22071# California Univ., Berkeley. Lawrence Radiation Lab.

A STUDY OF REGGE DYNAMICS IN PION-NUCLEON SCATTERING

John D. Stack (Ph.D. Thesis) 27 Apr. 1965 92 p refs
(Contract W-7405-ENG-48)
(UCRL-16115) CFSTI: HC $3.00/MF $0.75

A theoretical study is made of the MacDowell symmetry and the properties of fermion Regge poles. Subsequent to this, a set of Reggeized bootstrap equations for πN scattering is derived and analyzed. A careful discussion of kinematics is given, the inhomogeneous terms in the integral equation are constructed in detail, and the integral equation is transformed to one of standard Fredholm type. Author (NSA)

N66-22073# New Mexico State Univ., University Park.
SOME ELECTROMAGNETIC EFFECTS OF HIGH DENSITY GAMMA FLUX INTERACTING WITH MATTER
Clayborne Dudley Taylor Albuquerque, N. Mex., Sandia Corp., May 1965 71 p refs
(Contract AT(29-1)-789)
(SC-R-65-933) CFSTI: HC $3.00/MF $0.75

A metal slab is considered to be bombarded normally by a flux of gamma rays. As a result of this bombardment electrons are scattered from the slab with a distribution of velocities. This distribution is determined by the energies of the incident gamma rays and the slab thickness. An approximation to the velocity distribution is obtained for the case of gamma rays with the energy of 1.02 MeV—corresponding to the average energy of the gamma rays emitted from a nuclear explosion. A nonlinear integral equation describing the motion of the electrons egressing from a slab is derived. It is found to depend on the flux density of electrons egressing from the slab, and the distribution of the forward components of the electrons' velocities upon egressing from the slab, i.e., the velocity components along the normal to the slab. It is proved that the nonlinear integral equation can be solved by a method of successive approximations. Two special cases are treated: the flux density of the egressing electrons is considered to be approximately the electron flux density that is scattered from the slab by the gamma flux from a nuclear explosion, and the electrons are considered to egress from the slab with the same velocity—the average velocity of the electrons scattered from the slab by the gamma flux from a nuclear explosion, and all the electrons are considered to egress from the slab at once with a distribution of forward components of the velocities which crudely approximates the distribution for electrons scattered from the slab by the gamma flux from a nuclear explosion. After obtaining these equations of motion, the resulting electric fields are then found. It is shown that the formulation for the treatment of a slab being bombarded by gamma rays can be applied in treating the r-f radiation from a high altitude nuclear explosion. The results of this treatment are compared with those of the theory by Karzas and Latter, and a discussion of factors determining the RF radiation is presented. A monopole antenna is considered to be bombarded by a flux of gamma rays propagating normally to the axis of the antenna. As a result of this bombardment, electrons are scattered from the antenna, thus charging the antenna positively. This induces a current in the load impedance of the antenna—appearing as if the antenna were receiving a transient r-f signal. An expression for the time dependent voltage across the load impedance of the antenna is obtained by assuming that every electron scattered from the antenna never returns and that the antenna capacitance is the d-c capacitance. Author (NSA)

N66-22078# California Univ., Berkeley. Lawrence Radiation Lab.
ANALYTICITY AS A FUNDAMENTAL PRINCIPLE IN PHYSICS
Geoffrey F. Chew 26 Jan. 1965 19 p refs Presented at the 1964 Pisa Symp. on Nat. Philosophy Today, Pisa, Italy
(Contract W-7405-ENG-48)
(UCRL-11921; CONF-640915-1) CFSTI: HC $1.00/MF $0.50

The role of analyticity in established theories of macroscopic and atomic phenomena is briefly reviewed, with emphasis on the difficulty of using analyticity as a starting principle. Contrast is made with nuclear phenomena where experiments suggest the absence of arbitrary parameters and where analyticity of the S matrix seems attractive as an *a priori* theoretical postulate. The notions of maximal analyticity of first and second degree are discussed. Author (NSA)

N66-22079# California Univ., Berkeley. Lawrence Radiation Lab.
ANGULAR CORRELATIONS INVOLVING CONVERSION ELECTRONS
T. Yamazaki Apr. 1965 26 p refs Presented at the Intern. Conf. on the Internal Conversion Process, Nashville, Tenn., 10–13 May 1965
(Contract W-7405-ENG-48)
(UCRL-16027; CONF-650525-4) CFSTI: HC $2.00/MF $0.50

A brief summary is made of the advantages of angular correlation involving conversion electrons and of the current state of experimental apparatus. It is emphasized that conversion electrons in addition to K will provide important information of nuclear structure and the conversion process. Preliminary measurements on the 333 γ–356 K, L, M, and 333 K, L, M–356 γ angular correlations in ^{196}Pt are reported. A discussion is made of a possible rearrangement effect on the conversion coefficients of a nuclear transition which follows a converted transition in cascade. Author (NSA)

N66-22083# Virginia Univ., Charlottesville. Dept. of Physics.
[PHOTONEUTRON PRODUCTION CROSS SECTIONS FOR LIGHT NUCLEI] Final Report, 11 Mar 1961–15 Sep. 1964
W. D. Whitehead 15 Jan. 1965 47 p refs
(Contract AT(40-1)-2841)
(TID-21940)

Research on the determination of photoneutron production cross sections for light nuclei is summarized, and a list of papers on these studies is given. Three articles are included; separate abstracts were prepared for each. NSA

N66-22089# Princeton Univ., N. J. Palmer Physical Lab.
FREQUENCY SHIFTS IN ATOMIC BEAMS RESONANCES
William Happer, Jr. (Ph.D. Thesis) Jul. 1964 123 p refs
(Contract AT(30-1)-937)
(PUC-1964-148) CFSTI: HC $4.00/MF $0.75

Experimental and theoretical investigations of the resonance frequency shifts arising in atomic beams machines were carried out. Special attention was devoted to the effects arising from small inhomogeneities in the C field. The inhomogeneities were expressed in a power series along the path of the beam and the Schroedinger equation was integrated numerically for a realistically shaped r-f envelope to obtain resonance line shapes. Single quantum transitions and well separated multiple quantum transitions were studied. Experimental and theoretical results are in good quantitative agreement. A linear C field in homogeneity causes no frequency shift but broadens the resonance line and increases the r-f power required for optimum transition probability. Quadratic inhomogeneities small enough to have negligible effects on the resonance line width can cause large frequency shifts. The frequency shifts show regular oscillations with increasing r-f power. In multiple quantum transitions the frequency shifts caused by the r-f field can be as large as the shifts due to C field inhomogeneities. Prevision measurements of r-f magnetic fields were accomplished by using a small secondary r-f field of frequency ν_2 to induce transitions between the stationary states defined by the main r-f field at the frequency ν_1. Resonances may be observed at the frequencies $\nu_2=\nu_1-\nu_L$ and $\nu_2=\nu_L$ depending on the relative orientation of the r-f loops. Here ν_L is the splitting between

a pair of stationary states in the rotating coordinate system. The r-f field seen by the atom may thus be measured directly in gauss with an uncertainty determined by the linewidth of the resonance. Author (NSA)

N66-22092# California Univ., Berkeley. Lawrence Radiation Lab.
HIGH ENERGY POLARIZATION EXPERIMENTS AND REGGE POLES
Roger J. N. Phillips and William Rarita 10 Jun. 1965 31 p refs
(Contract W-7405-ENG-48)
(UCRL-16185) CFSTI: HC $2.00/MF $0.50

A survey is presented of the various types of polarization experiments that can be performed and of the predictions of Regge pole models. Specifically, π-N, K-N, $\bar{K}$-N, N-N, and $\bar{N}$-N scattering and polarization tensors of the first and second ranks only are considered. NSA

N66-22096# Maryland Univ., College Park. Dept. of Physics and Astronomy.
A STUDY OF HYPERFRAGMENTS PRODUCED BY 2.3-BeV/c K^- INTERACTIONS IN EMULSION
Ravinder Jit Prem (Ph.D. Thesis) Apr. 1965 115 p refs
(Contract AT(40-1)-2304)
(TID-21937) CFSTI: HC $4.00/MF $0.75

Studies were made of hyperfragments produced by 2.3–2.5 Bev/c K^- interactions in nuclear emulsion. The observed features of production are discussed in view of proposed models. The large abundance of short-range hyperfragments ($R \leq 5\mu$) is satisfactorily explained in terms of the spallation model. The longer range hyperfragments are a result of nuclear evaporation processes. Some evidence for the existence of direct-production or prompt-emission mechanism is found from the observation of forward-moving energetic light hyperfragments. The lifetimes of hydrogen and helium hypernuclei ($^3_\Lambda$H, $^4_\Lambda$H, and $^5_\Lambda$He) were measured. Also one in-flight and nine at-rest decays of $^4\text{He} \rightarrow ^3\text{He} + p + \pi^-$ were observed in an estimated time of 1.50×10^{-10} sec. The results are in agreement with the previous investigations, but with large statistical errors. These lifetimes are combined with similar experimental results and are then compared with the theoretical estimates. Also presented are the Λ-particle binding energies from 43 uniquely identified mesic decays. The results are in good agreement with previously reported values. Based on the analysis of two short-range mesic hyperfragments, the Λ-particle binding-energy limit is found to be 22.1 Mev. This value is consistent with previously reported values and also with theoretical estimates. Author (NSA)

N66-22097# Bettis Atomic Power Lab., Pittsburgh, Pa.
IMPROVED P_3 VACUUM BOUNDARY CONDITIONS AND THEIR USE IN PULSE CALCULATIONS
E. Schmidt and E. M. Gelbard Apr. 1965 13 p refs Presented at the 11th Ann. Meeting of the Am. Nucl. Soc., Gatlinburg, Tenn., Jun. 1965
(Contract AT(11-1)-GEN-14)
(WAPD-T-1788; CONF-650602-25) CFSTI: HC $1.00/MF $0.50

Calculations of neutron extrapolation lengths in pulsed water systems in the P_3 approximation are carried out using the Radkowsky and Nelkin kernels, and the results with both these kernels are found to disagree with experimental results on slab and spherical systems. Adjustments in the boundary conditions for the P_3 calculations are attempted, in order to improve the agreement between calculation and experiment. It is found, however, that although the P_3 calculations generally yield self-consistent results, the discrepancy between these results and experiment remains. NSA

N66-22098# Brandeis Univ., Waltham, Mass. Dept. of Chemistry.
CONTINUOUS REPRESENTATIONS IN THE STATISTICAL THEORY OF ELECTRONIC ENERGIES. THE H_2^+ ION
Technical Report No. 15
George S. Handler (Calif. Univ., La Jolla) and Sidney Golden [1965] 13 p refs Prepared jointly with Calif. Univ., La Jolla
(Contracts AT(30-1)-2968; Nonr-1677(01))
(TID-21692) CFSTI: HC $1.00/MF $0.50

A version of the statistical theory of electron energies, arising from a consideration of alternative partitionings of the Hamiltonian, was applied to the H_2^+ ion, yielding electron energies ~6% greater in magnitude than the exact theoretical values at several values of the internuclear separation. The binding energy at the theoretical equilibrium separation was calculated to be 0.1024 au compared to the experimental value of 0.1026 au. Author (NSA)

N66-22100# California Univ., Berkeley. Lawrence Radiation Lab.
COLLECTIVE EXCITATION OF NEUTRON-DEFICIENT BARIUM, XENON, AND CERIUM ISOTOPES: CENTRIFUGAL STRETCHING TREATMENT OF NUCLEI
Jack E. Clarkson (Ph.D. Thesis) May 1965 78 p refs
(Contract W-7405-ENG-48)
(UCRL-16040) CFSTI: HC $3.00/MF $0.75

The collective excitation of various neutron-deficient barium, xenon, and cerium isotopes by the "in-beam" method using lithium-drifted germanium counters was obtained. The (heavy ion, xn) reaction was used to produce ^{128}Ba, ^{124}Ba, ^{122}Xe, ^{120}Xe, and ^{134}Ce. The decay of ^{134}Pr to ^{134}Ce was also observed, with a half life of 17 ±2 min. Partial level schemes for the ground-state rotational bands to spin 8+ or 10+ are proposed for the nuclides investigated. The lifetime of the first excited state in ^{128}Ba was determined as an in-beam experiment to be $2.7 \pm 0.5 \times 10^{-10}$ seconds and, hence, gives the deformation of ^{128}Ba as $\beta = 0.24 \pm 0.02$. The implications of the rotational energies and spacings as related to deformation in this region are discussed. A classical centrifugal stretching treatment employing realistic nuclear potentials is developed, and the results of this and other works are compared to the calculated energy levels from this treatment. Author (NSA)

N66-22108# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'noi Fiziki.
SPECTRUM OF INTERNAL CONVERSION ELECTRONS IN α-DECAY OF Pu^{239} AND ENERGY LEVELS OF U^{235} [SPEKTR ELEKTRONOV VNUTRENNEI KONVERSII PROVAKHDAYUSHCHIKH α-RASPAD Pu^{239} I SKHEMA UROVNEI U^{235}]
E. F. Tret'yakov and L. N. Kondrat'ev 1964 20 p refs In RUSSIAN; ENGLISH summary *Its* Rept.-280
(NP-15251)

By means of a double ironless β-spectrometer with the toroidal field the spectrum of α-e_K coincidences of the

^{239}Pu sample in the region of electron energies 15–500 kev was investigated. The energies of the levels of the two known rotation bands ($K=7/2^-$ and $K=1/2^+$) were improved. A new rotation band appearing on the excited state of ^{235}U with the excitation energy 393.8 kev $K=3/2^+$ was found. The scheme of excited levels of ^{235}U is discussed.
Author (NSA)

N66-22113# Brussels Univ. (Belgium).
ON THE STABILITY OF THE HYPERNUCLEUS $_{\Lambda}He^{6}$
C. Willain May 1965 19 p refs *Its* Bulletin No. 20
(NP-15208)

In the present work, the result of an analysis of the $_{\Lambda}He^{6}$ hypernucleus in a three-body model alpha-neutron-hyperon (Λ0) is reported. This analysis is carried out by a variational calculation using a trial radial wave function with three variational parameters. The best potential to describe $_{\Lambda}He^{6}$ are considered to be a Yukawa Λ-nucleon potential; an exponential potential; and the α–n potential used in the phase-shift analysis of p–α scattering data. The result of a variational calculation using those hypotheses is that the $_{\Lambda}He^{6}$ hypernucleus is not bound.
Author (NSA)

N66-22115# Comitato Nazionale Per l Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.
PHOTOPRODUCTION OF K^+ FROM COMPLEX NUCLEI [FOTOPRODUZIONE DI K^+ DA NUCLEO COMPLESSO]
F. Knoke 26 Feb. 1965 16 p refs In ITALIAN *Its* Nota Interna No. 272
(LNF-65/6) CFSTI: HC $1.00/MF $0.50

The spectral distribution of K^+ in the laboratory system is calculated as a function of the angle of emission and the energy of the incident photon. The matrix element of photoproduction is calculated in the pulse approximation hypothesis. The effect of the optical potential on the moment distribution density of nucleons in the nucleus is discussed.
NSA

N66-22118# Paris Univ., Orsay (France). Laboratoire de l'Accelerateur Lineaire.
POLARIZATION OF RECOIL PROTONS FROM ELECTRON-PROTON SCATTERING AT 950 MeV
J. C. Bizot, J. M. Buon, J. LeFrancois, J. Perez Y. Jorba, and P. Roy Jun. 1965 39 p refs
(LAL-1138)

The recoil proton polarization in elastic high energy electron scattering on proton was measured in order to check the validity of first Born approximation in this reaction. The transverse polarization is proportional to the imaginary part of the second order term (two photon exchange term). 950Mev electrons were scattered in a liquid hydrogen target at about 90° c. of m. The recoil protons were analysed by a magnet system. Their polarization was then measured in a polarimeter constituted by a carbon scatterer and 4 spark chambers. The two transverse components of the polarization were calculated by a method derived from maximum likelihood. The component perpendicular to the scattering plane was found to be 0.040 ±0.027. The transverse component in the scattering plane was found to be 0.000 ±0.028.
Author (NSA)

N66-22120# California Univ., Berkeley. Lawrence Radiation Lab.
ANGULAR DISTRIBUTIONS OF CONVERSION ELECTRONS FROM ORIENTED Ce^{137m} NUCLEI
N. J. Stone, R. B. Frankel, and D. A. Shirley May 1965 6 p refs Presented at the Intern. Conf. on the Internal Conversion Process, Nashville, Tenn., 11–13 May 1965
(Contract W-7405-ENG-48)
(UCRL-11462, Rev.; CONF-650525-6) CFSTI: HC $1.00/MF $0.50

Experimental techniques are described which make possible the measurement of the energy dependence of charged-particle anisotropies from oriented nuclei. The application of these techniques to obtain the angular distribution of conversion electrons from oriented cerium-^{137m} is discussed. NSA

N66-22127# Syracuse Univ., N. Y. Dept. of Physics.
ORIGIN OF SYMMETRY AND SELF-COUPLING OF VECTOR MESONS
R. Musto, L. O'Raifeartaigh, and P. S. Rao [1965] 31 p refs
(Contract AT(30-1)-3399)
(NYO-3399-36) CFSTI: HC $2.00/MF $1.00

The case of a multiplet of vector mesons interacting with themselves by means of a trilinear interaction is considered from the point of view of the Smushkevich equations, which can be considered either as a subset of a set of self-consistency equations, or as a consequence of the Smushkevich Principle, which states that the interaction of the mesons with each other should be such that the non-degeneracy of the meson masses persists after the interaction is switched on. It is shown that for multiplets of low order, the Smushkevich equations determine the number of particles in the multiplet, and it is conjectured that this is generally true. The physically interesting case of eight vector mesons is considered in detail. It is shown that if the coupling is anti-symmetric in all indices and the charge is conserved, then the Smushkevich equations imply that the interaction is SU_3-invariant. If the interaction is not completely anti-symmetric the algebra becomes much more complicated, but if one simplifies it by assuming isotopic spin and hypercharge conservation, one obtains a plausibility argument in favor of SU_3 invariance.
Author (NSA)

N66-22130# Los Alamos Scientific Lab., N. Mex.
THE INTERPRETATION OF NUCLEAR EXCITATION FUNCTIONS AT HIGH ENERGY: ERICSON FLUCTUATIONS
William R. Gibbs 27 May 1965 58 p refs
(Contract W-7405-ENG-36)
(LA-3266) CFSTI: HC $3.00/MF $0.75

The interpretation of the nuclear reaction excitation function by statistical methods has been reviewed and results regarding errors and corrections have been presented. Special emphasis is placed on the effects of finite sample size on the amount of direct-reaction cross section extracted. Also treated are the effects of counting statistics, generalized frequency distribution functions, and the effect of finite sample size on frequency distribution functions.
Author (NSA)

N66-22133# California Univ., Berkeley. Lawrence Radiation Lab.
DATA ON PARTICLES AND RESONANT STATES
Arthur H. Rosenfeld, Angela Barbaro-Galtieri, Walter H. Barkas, Pierre L. Bastien, Janos Kirz et al Mar. 1965 37 p refs
(Contract W-7405-ENG-48)
(UCRL-8030, Pt. 1) CFSTI: HC $2.00/MF $0.50

The data are summarized in three tables. Table 5 covers all the stable particles: leptons, mesons, and baryons, i.e., those states which are immune to decay via the strong interaction. There are two tables of data on the unstable particles, one on meson resonances and one on baryon resonances. These tables include basic information on stable mesons and baryons. Each table is of slightly different form; thus Table 5 includes mass differences and magnetic moments, whereas the baryon table includes information on what pion and K-meson beams will form certain resonances. NSA

N66-22134# Oak Ridge National Lab., Tenn.
SADDLE POINT ROTATIONAL STATES FROM RESONANCE FISSION OF ORIENTED NUCLEI
J. W. T. Dabbs, F. J. Walter, and G. W. Parker [1964] 13 p refs Presented at the Symp. on the Phys. and Chem. of Fission, Salzburg, Austria
(Contract W-7405-ENG-26)
(ORNL-P-1067; SM-60/5; CONF-650301-8) CFSTI: HC $1.00/MF $0.50

An extension is made of experiments on the measurement of fission fragment anisotropy from ^{235}U in a $UO_2Rb(NO_3)_3$ single crystal to selected neutron energies in the resonance range and to temperatures down to 0.45°K. The theoretical aspects of the problem are discussed, and the experimental apparatus and results are described. NSA

N66-22135# California Univ., Berkeley. Lawrence Radiation Lab.
DYNAMICS OF A SINGLET AND AN OCTET OF $D_{3/2}$ MESON-BARYON COMPOSITE STATES
Paul du T. van der Merwe (Ph.D. Thesis) 26 Aug. 1965 64 p refs
(Contract W-7405-ENG-48)
(UCRL-16366) CFSTI: HC $3.00/MF $0.75

The $D_{3/2}$ meson-baryon resonances are investigated on the basis of a multichannel Bethe-Salpeter equation in the unitary symmetry limit. The driving mechanism consists of a box diagram which provides strongly attractive D-state forces corresponding to the unitary singlet and octet states. A reduction of the Bethe-Salpeter equation to a single-dimensional relativistic integral equation which incorporates two-body unitarity is effected along the lines of a method of Blankenbecler and Sugar. The equation is solved by the determinantal method. The model accounts for a singlet and gamma octet of composite states. Relevant results on the application of the methods of parity and helicity amplitudes to integral equations are presented.
Author (NSA)

N66-22137# Academia R. P. R., Bucharest (Romania). Institutul de Fizica Atomica.
ALPHA REDUCED WIDTHS ON SUPERFLUID MODEL WITH PROJECTED WAVE FUNCTIONS
A. Sandulescu 1965 8 p refs
(IFA-FT-55)

On the basis of the superfluid model with projected wave functions, explicit expressions of the reduced widths for alpha transitions to the rotational band of intrinsic states are given. Author

N66-22139# Oak Ridge National Lab., Tenn.
PUSLED-NEUTRON MEASUREMENT OF THE DIFFUSUION PARAMETERS IN ORDINARY ICE AS A FUNCTION OF TEMPERATURE
Ernest Gerard Silver [1964] 19 p refs Presented at the IAEA Symp. on Pulsed Neutron Methods, Karlsruhe, West Germany
(Contract W-7405-ENG-26)
(ORNL-P-1167; CONF-650504-4) CFSTI: HC $1.00/MF $0.50

Studies of neutron diffusion in H_2O ice were undertaken to determine whether the neutron spectrum becomes asymptotic in relatively short times at low temperatures and what the temperature effects on the diffusion coefficient and the diffusion cooling coefficients are. The preparation of the ice cylinders is described. Neutrons were produced by a deuteron beam incident on a deuterium target and were detected by a ^6LiI(Eu) crystal scintillator. Dimensions and bucklings of the cylinders used are listed. Neutron time decay was measured for each cylinder at temperatures from −85 to −5°C. Decay data were analyzed using a nonlinear least-squares fit computer program. Decay constants measured for each buckling and temperature are shown. Diffusion parameters were calculated from the measured cylinder dimensions and decay periods by an iterative procedure. No noticeable trapping effect was found in ice, and the inverse absorption lifetime was found to be independent of temperature. Values of the diffusion and diffusion cooling coefficients are compared with those from previous experiments and calculations.
Author (NSA)

N66-22141# Deutsche Akademie der Wissenschaften zu Berlin (East Germany).
DETERMINATION OF FAST NEUTRON SPECTRA IN IRON BY MEANS OF THRESHOLD DETECTORS [BESTIMMUNG SCHNELLER NEUTRONENSPEKTREN IN EISEN MITTELS SCHWELLWERTDETEKTOREN]
Karlheinz Fährmann Jun. 1964 81 p refs In GERMAN
(ZFK-RN-27)

The work is for the preparation of spectrum measurements in the fast charge lattice in the Rossendorf ring-zone reactor. As rough calculations for the system shown, the knowledge of the neutron spectrum in the energy range <1 Mev is of special significance. Therefore measurements in iron were carried out where the "soft" part of the spectrum is strongly increased by inelastic attenuation of fast neutrons. The measurements are, moreover, of practical interest since iron plays an important role as shielding material in the reactor. Various inelastic scattering processes, in which isomeric nuclei with low lying levels (<350 kev) and half life times of 10 min$<t_{1/2}<$12 days were formed, were investigated for their suitability in neutron spectrometry. By means of the reactions $^{103}Rh(n,n')^{103m}Rh$, $^{115}In(n,n')^{115m}In$, and the conventional threshold reactions $^{32}S(n,p)^{32}P$, $^{27}Al(n,p)^{27}Mg$, and $^{27}Al(n,\alpha)^{24}Na$, the neutron spectra in an iron block (50 cm $\phi\times$45 cm) were determined for incident fission neutrons. In order to avoid absolute measurements, the probes were calibrated in a thin enriched uranium converter. A perturbed fission spectrum was assumed as a spectrum model, in which the perturbation function was represented as a superposition of exponential functions. The spectra measured were compared with those from a multi-group diffusion calculation. The energy sensitivity of the reactions chosen was compared with that of the fission reactions (^{237}Np, ^{234}U, ^{236}U, and ^{238}U).
Author (NSA)

N66-22144# Michigan Univ., Ann Arbor.
COLLISION INDUCED MIXING IN THE FIRST EXCITED STATES OF THE ALKALIES

James Adam Jordan, Jr. (Ph.D. Thesis) 1964 122 p refs (Contract AT(11-1)-1112)
(TID-21817) CFSTI: HC $4.00/MF $1.00

Cross sections for noble-gas induced transitions between fine structure levels in the first excited states of alkali atoms were determined experimentally and theoretically. Calculations were performed for the leading terms in the electrostatic interaction between the noble gas and alkali atoms; detailed consideration was given to the van der Waals and dipole-quadrupole terms. The theory of the experiments is discussed, considering the gas kinetic rate equations applicable to mixing between fine structure levels. The transfer of excitation from one of the fine structure levels to the other was measured as a function of noble gas pressure, using resonance fluorescence techniques; results are given for sodium- and potassium-noble gas mixtures. NSA

N66-22147# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Siebersdorf (Austria). Physik-Institut.
MEASUREMENT OF THE KINETIC ENERGY OF FISSION FRAGMENTS FROM U-235 FISSION [MESSUNG DER KINETISCHEN ENERGIE DER SPALTBRUCHSTUCKE VON DER U-235 SPALTUNG]
M. Schneeberger and H. P. Axmann 26 Oct. 1964 8 p In GERMAN Presented at the Autumn Session of the Austrian Phys. Soc., Graz, Austria, 1964
(SGAE-PH-10/1964)

Phosphorus-diffused (np) silicon detectors were used in ionization study of the kinetic energy of fission fragments from 235U fission. The energy distribution of the fission fragments was measured to determine the counting properties of the semiconductor detectors. For the measurement of the kinetic energy, a two-detector system with the uranium foils, two amplifier stages, and recording unit was used. A two-dimensional energy analysis was made of the kinetic energy in the form of a contour diagram. NSA

N66-22159# Paris Univ., Orsay (France). Lab. of the Linear Accelerator.
ELECTRON-NUCLEUS SCATTERING AT 180°
J. Goldemberg Apr. 1965 31 p refs
(LAL-1132)

The experimental set-up to measure large-angle electron scattering at relativistic energies is described, including the magnetic spectrometer and auxiliary deflecting magnet. Examples of the use of large-angle scattering in nuclear spectroscopy are discussed, including obtaining data on static magnetic moments of light nuclei and their form factors, on spin-parity and width of magnetic transitions, and on excitation of El levels in the giant resonance region. Possibilities of large-angle scattering studies for investigating the nonexistence of an electric dipole moment of the electron, the universality of weak interactions in nuclear muon capture, and the role of exchange currents in the nucleus are considered. Examples of previous experimental and calculated results illustrating these applications are cited. NSA

N66-22181*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DYNAMICS OF $T=2\sigma-\pi$ SYSTEM. I
Kashyap Vasavada [1965] 26 p refs Submitted for Publication
(NASA-TM-X-56499) CFSTI: HC $2.00/MF $0.50 CSCL 20H

A dynamical calculation using Balazs type N/D method is performed for the $T=2\Sigma-\pi$ system in $P_{3/2}$ state. Self-consistent solutions for the position and residue of a resonance are obtained for wide range of the relevant Yukawa coupling constants and different sets of matching points. Some remarks are made regarding interpretation of the results. Author

N66-22192*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXCITATION OF ATOMIC HYDROGEN BY LITHIUM ATOMS
Ian M. Cheshire and Herbert Lee Kyle [1965] 8 p refs Submitted for Publication
(NASA-TM-X-56457) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The excitation of atomic hydrogen in collisions with lithium atoms was examined. Born cross sections were derived, for excitation of the hydrogen atom to a state with principle quantum number n, when the lithium atom is in its ground state and in the excited state. The total Born cross section was obtained by summing all possible final states of the lithium atom. The results of the investigation are tabulated and it is noted that the application of a simple hydrogenic wave function for lithium, with an effective charge $Z=(1.6)^{1/2}$, increased the tabulated results by 20%. H.S.W.

N66-22193*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DYNAMICS OF $J=3/2^+$ K Ξ AND KN SYSTEMS IN THE 27 FOLD REPRESENTATION Technical Report No. 455
Jogesh C. Pati (Maryland Univ.) and Kashyap Vasavada Apr. 1965 19 p refs Submitted for Publication Prepared in cooperation with Maryland Univ.
(Grants NsG-398; NSF GP-3221; AF-AFOSR-500-64)
(NASA-TM-X-56502) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The dynamical singularities of the partial wave amplitude are assumed to arise mainly from the nearby cut (due to Σ and Λ exchange in the crossed channel) and the far left hand cut ($-\infty<s\leq 0$). The contribution of the former is evaluated explicitly in terms of the relevant Yukawa coupling constants and that of the latter, by the method of Balázs, through the introduction of effective range pole terms. We find that for a wide range of choice of the relevant Yukawa coupling constants, there exist self-consistent bound state (or resonant) solutions for both I=1, $\bar{K}\Xi$ and KN-systems. Self-consistent solution for the position in case of the former is found to lie in the range 1650–1870 MeV and that for the latter in the range 1300–1600 MeV. The overall conclusion is found to be rather insensitive to the choice of the relevant Yukawa coupling constants. It is discussed in the appendix that it appears to be a typical feature of Balázs type procedure for treating the far left hand singularities, that in almost any $J=3/2^+$ baryon-meson system one would obtain self-consistent bound state or low lying resonant solution, unless the Born terms are very strongly repulsive. Author

N66-22211*# Southwest Center for Advanced Studies, Dallas, Tex.
COLLISIONAL-DISSOCIATIVE RECOMBINATION OF ELECTRONS WITH MOLECULAR IONS
C. B. Collins Mar. 1965 42 p refs Submitted for Publication
(Grant NsG-269-69)
(NASA-CR-64053) CFSTI: HC $2.00/MF $0.50 CSCL 20H

The recombination rate of electrons in a hypothetical plasma containing ions of a molecule having both repulsive and bound neutral states is calculated for electron densities between 10^{10} and $10^{14}/cm^3$ and temperatures ranging from 250°K to 2000°K. It is found that if the molecule has a

dissociative state located sufficiently close in energy to the molecular ion, values are obtained considerably in excess of the collisional–radiative recombination rate for systems possessing only bound states. Author

N66-22214*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
SYSTEMATICS OF FISSION BASED ON THE EXPONENTIAL MASS FORMULA
A. G. W. Cameron [1965] 17 p refs Submitted for Publication
(NASA-TM-X-56635) CFSTI: HC $1.00/MF $0.50 CSCL 20H

A simple function of the fissionability parameter Z^2/A is found which enables fission thresholds to be calculated relative to the exponential mass formula reference surface (with shell and pairing corrections omitted). From these thresholds, systematics of spontaneous fission rates and of the ratios of neutron to fission widths are developed. A discussion is given of multiple neutron capture experiments in the light of these fission characteristics. Author

N66-22237*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
COMPOSITION OF MATTER IN NUCLEAR STATISTICAL EQUILIBRIUM AT HIGH DENSITIES
Sachiko Tsuruta and A. G. W. Cameron [1965] 34 p refs Submitted for Publication
(NASA-TM-X-56655) CFSTI: HC $2.00/MF $0.50 CSCL 20H

Various properties of dense matter in nuclear statistical equilibrium are studied for densities and temperatures in the range $10^6 \leq \rho \leq 10^{12}$ gm/cm^3 and $2\times10^9 \leq T \leq 10^{10}$ °K. With increasing density the stability shifts to more and more neutron-rich nuclei. With increasing temperature the general tendency is that nuclei of smaller charge become more abundant, and the abundances of nuclei near a peak tend to become nearly as large as that of the peak nucleus. For densities $\leq \sim 10^6$ gm/cm^3, the ordinary iron group nuclei are most stable until the temperature becomes about 5×10^9°K; for higher temperatures matter in equilibrium consists of almost pure helium. When $T \geq 10^{10}$°K, matter consists of almost pure neutrons at all densities. Rates of beta reactions and neutrino emission generally increase with increase of density and temperature. Author

N66-22251# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DOUBLE COMPTON EFFECT WITH HIGH INTENSITY RADIATION
Olowig von Roos [1965] 23 p refs Submitted for Publication
(Contract NAS7-100)
(NASA-CR-62146) CFSTI: HC $1.00/MF $0.50 CSCL 20H

A semiclassical calculation of the double Compton effect of an electron subjected to a high-intensity, monochromatic, linearly-polarized electromagnetic wave (laser beam) is presented. The cross section for the simultaneous scattering of two photons of the laser beam and their conversion into one photon of twice the frequency (second harmonic generation) is discussed in detail. The results may be summarized as follows: (1) there is no intensity-dependent frequency shift for the scattered photons; (2) the cross section is a very sensitive function of the laser beam frequency w_o and the initial velocity of the electron; (3) for present day laser beam intensities and available electron velocities the total cross section turns out to be about 10^2 times the Thomson cross section (6.65×10^{-25} cm^2) under favorable conditions and is therefore readily amenable to observation; and (4) the calculations predict a marked dependence of the differential as well as the total cross section on the angle between the initial velocity of the electron and the direction of polarization of the laser beam. Author

N66-22305*# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
ELECTRON COLLISION CROSS SECTIONS IN METAL VAPORS Summary Report
J. F. Nolan 26 Jan. 1966 66 p refs Rept.-66-9E5-SPLAS-R1 (Contract NAS3-7100)
(NASA-CR-54670) CFSTI: HC $3.00/MF $0.75 CSCL 20H

The Townsend α coefficient and electron drift velocity have been measured in cesium–helium mixtures as a function of E/p, the ratio of electric field to total pressure, and N_{Cs}/N_{He}, the ratio of cesium to helium density. By comparing the measured values with the results of a numerical solution of the Boltzmann equation using assumed cesium cross sections, one obtains cross sections consistent with the measurements. A total excitation cross section for cesium having a peak value of 1.15×10^{-14}cm^2 at 8 eV gives good agreement with experiment. Author

N66-22363*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
CALCULATION OF TRANSPORT PROPERTIES OF IONIZING ATOMIC HYDROGEN
Norman T. Grier Washington, NASA, Apr. 1966 87 p refs
(NASA-TN-D-3186) CFSTI: HC $1.25/MF $0.75 CSCL 20H

The viscosity, thermal conductivity, electrical conductivity, binary diffusion coefficient, multicomponent diffusion coefficient, and thermal diffusion coefficient are calculated for equilibrium ionizing atomic hydrogen for temperatures from 5000° to 40,000°K at pressures from 10^{-5} to 10^2 atmospheres. Rigorous first- and second-approximation equations are used throughout. The collision cross section for all the interactions are presented in tabular form. Author

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see 20 Propulsion Systems.

N66-21140# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
STUDY OF THE MACROSCOPIC EQUATIONS OF PLASMA AND OF THE COLLISION TERMS IN VIEW OF AN APPLICATION TO REENTRY PLASMAS [ETUDE DES EQUATIONS MACROSCOPIQUES DE PLASMA ET DES TERMES DE COLLISIONS EN VUE DE L'APPLICATION AUX PLASMAS DE RENTREE]
Jackques Dorey Dec. 1965 30 p refs In FRENCH; ENGLISH summary Publ. No. 112 (1965)
CFSTI: HC $2.00/MF $0.50

A survey of the work leading to the macroscopic equations is presented. These equations are extended to a plasma including chemical reactions. The terms of exchange through elastic collisions are determined in the case of "billiard-ball

collisions. The elastic and super-elastic collisions are indexed and analyzed from the energetic viewpoint. A group of equations which may describe hypersonic plasma properties is finally obtained; the terms of energy exchange through inelastic collisions appear as a global term. Author

N66-21166# Harvard Univ., Cambridge, Mass. Engineering Sciences Lab.
THE SPECTROSCOPIC MEASUREMENT OF TEMPERATURES IN AN ARGON PLASMA ARC
J. F. Bott Dec. 1965 33 p refs
(Grant NSF GK-65)
(TR-24)

Temperature profiles across the Poiseuille plasma arc have been calculated from measured radiation intensities from the atmospheric argon plasma at arc currents from 1 A to 400 A. The transition probabilities for several neutral argon lines were calculated from the measurements. The investigation shows the central core of the arc to be in local thermodynamic equilibrium but the sides of the arc to deviate from local thermodynamic equilibrium. The extent of this deviation was found to increase with decreasing current. Author

N66-21187# Max-Planck-Institut für Physik und Astrophysik, Munich (West Germany).
DETERMINATION OF ELECTRON DENSITY FROM LINE MERGING
C. R. Vidal Nov. 1965 33 p refs Submitted for Publication
(MPI-PAE/PL-7/65) CFSTI: HC $2.00/MF $0.50

The often used Inglis Teller relation estimates the electron density from the line merging within a factor of two. A new method of evaluation is suggested, which gives the electron density from the ratio of the envelope curves of the merging lines. The achievable accuracy is about 5% as long as prescribed conditions are fulfilled. Author

N66-21195# Aerojet-General Nucleonics, San Ramon, Calif.
RESEARCH IN HIGH TEMPERATURE PLASMA FOR SPACE APPLICATIONS. VOLUME II: ENGINEERING Annual Report, Jul. 1963–Jul. 1964
John S. Luce Wright-Patterson AFB, Ohio, AF Aero Propulsion Lab., Oct. 1964 397 p refs
(Contract AF 33(657)-11183)
(AN-1255, Vol. II; APL-TDR-64-124, Vol. II; AD-624486) CFSTI: HC $7.00/MF $1.75

The purpose of the work described in this volume is to provide the engineering analysis and design of a mirror-cusp magnetic bottle for plasma physics experiments. The original design concept and experiments were described in AGN Report AN-1103 (November 1963). The principal design requirements were: maximum field of 50 kgauss; mirror ratio of 2; alpha of 1.4; containment volume of 2 ft diameter × 8 ft length; and dynamic vacuum of 10^{-8} torr. The principal design problems were heat transfer, pressure drop, and mechanical stresses. Each of these problems was analyzed with accepted engineering formulae. A design was obtained having a safety factor of 3 to yield, except the axial coil winding, which has a safety factor of 2.2 to yield. The complete unit weighs 80 tons and is composed of hand-drawn ETP copper windings and a 304 stainless steel structure. Water-methanol or liquid nitrogen can be used for coolant. Author (TAB)

N66-21202# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
ON THE APPLICATION OF NOISE TECHNIQUE TO THE DIAGNOSTICS OF MAGNETOHYRODYNAMICS [MOZLIWOSCI ZASTOSOWANIA TECHNIKI SZUMOWEJ DO DIAGNOSTYKI PRZEPLYWU MAGNETOHYDRODYNAMICZNEGO]
W. Ciechanowicz Apr. 1965 25 p
(Rept.-626/IX/R) CFSTI: HC $1.00/MF $0.50

The paper is concerned in considering the possibility of the application of noise analysis in the diagnostics of MHD flow. Two methods of the noise technique have been discussed. Both of them can be used to determine the dynamic characteristics from which we conclude the properties of ionized gas. As an example of such application of these methods, the estimation of electrical conductivity has been discussed. The second method can be also useful to design the distribution of parameter deviations from the fixed steady state and its time dependance when the direct measurement of the considered parameter is impossible. Although the range of validity of this method seems to be restricted because of linearization it can be valuable in investigations of the stability conditions of magnetohydrodynamic flow.
Author

N66-21204# Cornell Univ., Ithaca, N. Y. Graduate School of Aerospace Engineering.
ELECTROHYDRODYNAMIC FLOW OVER A WAVY WALL
S. Kuwabara Jun. 1965 118 p refs
(Grant AF-AFOSR-399-64)
(AFOSR-65-1768; AD-624506) CFSTI: HC $4.00/MF $0.75

Electrohydrodynamic flow of a simple, isothermal gas without dissipative effects over a wavy wall is investigated by the perturbation method. The unperturbed flow has a uniform velocity and nonuniform distributions of density and electric field which vanish at infinity. For the subsonic flow, the surface pressure the stream lines and the electric-field lines are calculated. For the supersonic flow, the linearized solution diverges at infinity. This seems to be due to the non-uniform density distribution of the undisturbed flow. Numerical solutions of an oscillating-piston problem which is a simplified model for the high supersonic flow, are obtained. Some related problems are also investigated. Author (TAB)

N66-21227# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
MICROWAVE INTERFEROMETER MEASUREMENTS OF THE ELECTRON DENSITY DISTRIBUTION BEHIND SHOCK FRONTS AND DISCHARGE PLASMAS [MIKROWELLEN-INTERFEROMETRISCHE MESSUNGEN DER RAUMLICHEN ELEKTRONEDICHTEVERTEILUNG HINTER STOSSFRONTEN UND ENTLADUNGSPLASMEN]
W. Makios Dec. 1965 26 p refs Presented at the 26th Meeting of the Propulsion and Energetic Panel of AGARD, Pisa, Italy, 8 Sep. 1965
(IPP-3/28) CFSTI: HC $2.00/MF $0.50

Previously, various investigators have shown, that in electromagnetically driven shock waves the luminous front is generated from parts of the discharge plasma, in front of which the shock front is propagating. In order to measure the electron density distribution behind the shock front, microwave transmission interferometric measurements were made. The space resolution achieved with horn antennas and focusing lenses was unsatisfactory, because the distance between the shock front and the discharge plasma is of the order of a few wavelengths. With the use of Lecher wires instead of horn antennas, we obtained a space resolution of about half a wavelength. Author

N66-21257# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
INSTITUT FUR PLASMAPHYSIK GmbH MUNICH—GARCHING AND THE EXPERIMENTAL DEPARTMENT (PLASMA PHYSICS) OF THE MAX-PLANCK-INSTITUT FOR PHYSIK AND ASTROPHYSIK, MUNICH Annual Report, 1964
[1965] 160 p refs
CFSTI: HC $5.00/MF $1.00

Experimental and theoretical work continued on the possibility of producing hot plasmas and maintaining them over such long periods and at such high temperatures that a substantial quantity of plasma is converted by energy-yielding thermonuclear reactions. Three approaches were used: production by rapid magnetic compression (theta pinch) of a plasma of high temperature and not too low density; production of an almost fully ionized plasma in almost stationary thermal equilibrium; and an investigation of model plasmas without approximating the state variables of fusion plasma. Magnetohydrodynamic generator development concentrated on the possibility of maintaining the electrons at a higher temperature than the rest of the gas. The technical developments accomplished by the engineering department are described. N.E.N.

N66-21258# United Kingdom Atomic Energy Authority, Culham (England).
THE EXPULSION OF MAGNETIC FLUX BY EDDIES
N. O. Weiss Sep. 1965 46 p refs Submitted for Publication
(CLM-P89)

A convective eddy imposed on an initially uniform magnetic field in a highly conducting fluid distorts the lines of force and amplifies the field. Flux is concentrated outside the eddy; within it, the field grows and its scale of variation decreases until resistive effects become important. Closed lines of force are then formed by reconnexion. The central field decays and a steady state is reached. Within a period small compared with the characteristic time for resistive decay, magnetic flux is almost entirely expelled from regions of rapid motion and concentrated at the edges of convection cells. This process is demonstrated by numerical experiments. The results are applied to the sun, where the concentrated fields are strong enough to inhibit convection locally.
Author

N66-21271# Atomic Energy of Canada, Ltd., Chalk River, (Ontario).
ELECTROMAGNETIC FIELDS ASSOCIATED WITH THE INITIATION OF CURRENT BETWEEN PARALLEL PERFECTLY CONDUCTING PLANES
G. E. Lee-Whiting Jan. 1966 28 p refs
(AECL-2531; FSD/ING-33) CFSTI: HC $2.00/MF $0.50

The transient electromagnetic field associated with the sudden initiation of a uniform and steady current throughout a right circular cylindrical region between a pair of parallel perfectly conducting planes is calculated. The flow of energy is discussed. Author

N66-21281# United Kingdom Atomic Energy Authority, Culham (England). Culham Lab.
THE EFFECT OF COULOMB COLLISIONS ON THE SCATTERING OF LIGHT BY PLASMAS
T. J. M. Boyd Oct. 1965 20 p refs
(CLM-R-52) HMSO: 3s

The effect of Coulomb collisions on the low frequency ion acoustic resonance is estimated using a simple hydrodynamic approach, and the line profile obtained is compared with that found by DuBois and Gilinsky in the limit of collision-dominated plasmas. In the neighborhood of the ion acoustic resonance the results from the two approaches are identical but the line shape in the region of zero frequency predicted by the DuBois–Gilinsky calculation is distinct from that found here. The main result is that the low-frequency ion feature narrows significantly in collision dominated plasmas. In situations intermediate between the collisionless plasma and the collision-dominated plasma the determination of the line profile has not yet been carried out. The contribution of Coulomb collisions to the broadening of the feature at the electron plasma frequency, sometimes called the plasma line or satellite feature, has also been estimated and compared, over a range of parameters, with the contribution due to the Landau damping in a collision-free plasma. It is shown that over the range of parameters covered by the Culham experiments, collision effects are not important. Author

N66-21288# Texas Univ., Austin.
TIME-SPACE RESOLUTION OF B-FIELDS IN THETA-PINCH PLASMA BY FARADAY ROTATION OF INFRARED MASER RADIATION Interim Technical Report
John P. Craig, Robert F. Gribble, and Arwin A. Dougal Wright-Patterson AFB, Ohio, ARL, Jun. 1965 122 p refs
(Contract AF 33(657)-11073)
(ARL-65-129; AD-626938) CFSTI: HC $4.00/MF $0.75

A method for experimentally determining the magnetic flux density B as a function of time and space in a dense, extreme temperature, highly dynamic, deuterium plasma was developed. The method employed the 3.39 u infrared radiation from a HeNe gas maser as a probe. The plasma electron density and the Faraday rotation of the plane of the polarization of the maser beam which propagated through the plasma were measured separately. These two measurements and the laws of propagation of electromagnetic waves in a magnetized plasma were used to deduce the magnetic field B in the plasma.
Author (TAB)

N66-21355*# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.
CYLINDRICAL SHOCK MODEL OF THE PLASMA PINCH
Glen A. Rowell Feb. 1966 54 p refs *Its* Rept.-742
(Grant NsG-306-63)
(NASA-CR-71412) CFSTI: HC $3.00/MF $0.50 CSCL 20

A model of the plasma pinch is formulated which represents the imploding current sheet as an impermeable piston that drives a gasdynamic shock wave ahead of it toward the axis of the discharge. This cylindrical piston-shock problem is solved without further reference to electromagnetic effects. First the Lagrangian equations are solved for a parabolic shock trajectory in the r-t plane yielding a first and second approximation for the piston trajectory. To determine the accuracy of the approximation, the same problem is solved for a straight shock in the r-t plane by the method of characteristics in using the Eulerian formulation. It is found that the solutions given by the two methods compare exactly where a solution to the problem using the method of characteristics exists. The results are in qualitative agreement with relevant experimental observations. Author

N66-21378# Electro-Optical Systems, Inc., Pasadena, Cal
BASIC RESEARCH ON GAS FLOWS THROUGH ELECTRIC ARCS. PHASE III: STUDIES OF THE INLET REGION Final Technical Report

G. L. Mariotte, and P. D. Lenn Wright-Patterson AFB, Ohio. ARL, Nov. 1965 196 p refs *Its* Rept.-2181 (AF 33(657)-7940)
(EOS-2181-Phase III-Final; ARL-65-231; AD-628268) CFSTI: HC $9.60/MF $0.75

Experimental and theoretical investigations dealing with interaction phenomena in the inlet or gas heating region of a segmented water-cooled constricted arc are reported. A simple arc column theory including radiation is considerably refined to yield comprehensive scaling parameters for both the fully developed and the inlet regions of the arc. Extensive measurement on nitrogen, argon and hydrogen in both regions are listed and compared in detail with various aspects of the scaling theory. Author (TAB)

N66-21399# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
STUDY OF COLLISION PROCESSES IN GASEOUS PLASMAS Status Report, 1 Jul.–1 Oct. 1965
H. J. Oskam [1965] 5 p
(Contract Nonr-710(37))
(SR-7; AD-622684) CFSTI: HC $1.00/MF $0.50

Studies related to collision processes in gaseous plasmas are summarized for the period July 1, 1965 to October 1, 1965. The main results obtained are related to recombination mechanisms in helium and neon, and to the mobility of positive ions in helium. TAB

N66-21471# Northwestern Univ., Evanston, Ill. Gas Dynamics Lab.
MICROWAVE DETERMINATION OF ANISOTROPIC PLASMA ELECTRON DENSITY PROFILES
R. C. Warder, Jr. and D. L. Nector Aug. 1965 152 p refs
(Grants AF-AFOSR-62-307; AF-AFOSR-63-329)
(NU-GDL-B-3-65; AFOSR-65-2215; AD-627267) CFSTI: HC $5.00/MF $1.00

A method for the determination of the spatial electron density distribution in plasmas subjected to external magnetic fields is presented. The method involves the measurement of the Faraday rotation angle as a function of the external magnetic field strength. Results of calculations of normalized Faraday rotation angle versus normalized electron cyclotron frequency for various assumed electron density distributions are given. Author (TAB)

N66-21502# RAND Corp., Santa Monica, Calif.
ASYMPTOTIC INTEGRATION OF THE EQUATION GOVERNING MAGNETOHYDRODYNAMIC FLOW WITH ALIGNED VELOCITY AND MAGNETIC FIELDS
S. A. Berger Jan. 1966 25 p refs
(Contract ARPA SD-79; ARPA Order 189-61)
(RM-4788-ARPA; AD-627885) CFSTI: HC $1.00/MF $0.50

The planar flow of an infinitely conducting fluid moving in such a way that the velocity and magnetic fields are always aligned can be analyzed by means of the hodograph technique. The partial differential equation for the stream function in hodograph variables is linear and may be solved by separation of variables. One of the two resulting ordinary differential equations is immediately solvable in terms of trigonometric functions; the other is, for general values of the adiabatic exponent, a second order linear differential equation with very complicated variable coefficients. The asymptotic behavior of the solutions of this latter equation for large values of the separation constant is obtained. The asymptotic expansion of the derivative of the solution is also given explicitly. The results reduce to the well-known asymptotic forms of the Chaplygin function and its derivative when the magnetic field is set equal to zero. Author (TAB)

N66-21594# United Kingdom Atomic Energy Authority, Culham (England).
MICROWAVE EMISSION FROM PLASMAS AT HARMONICS OF THE ELECTRON CYCLOTRON FREQUENCY
T. J. M. Boyd 1966 27 p refs
(CLM-R-51) HMSO: 4s

A mechanism is proposed to account for the anomalously large microwave emission from certain plasmas in the neighbourhood of harmonics of the electron cyclotron frequency, found in recent experiments. This mechanism involves the scattering of electron plasma waves propagating almost orthogonally to the magnetic field by fluctuations in the ion plasma density; a wave–wave interaction leads to the conversion from one wave type (primarily longitudinal) to another (transverse). A kinetic theory calculation based on this model gives an emission spectrum which may be compared with the observations. Author

N66-21655*# General Motors Research Labs., Warren, Mich.
CESIUM PLASMA SPECTROSCOPY. ELECTRON NUMBER DENSITY MEASURED BY STARK SHIFT OF SPECTRAL LINES Final Report
R. J. Majkowski and R. J. Donohue 14 Jan. 1966 43 p refs
(Contract NAS3-6470)
(NASA-CR-71394) CFSTI: HC $3.00/MF $0.75 CSCL 20I

The widths and shifts of atomic spectral lines were measured for an rf (8 Mc) electrodeless cesium discharge in which the electron density was varied from 0.5 to 3×10^{14} cm^{-3} with a temperature range from 2500 to 3100°K. The measured shifts were from 0.008 to 1.4 Å and shift to width ratios were from 0.33 to 1.40. These measurements were compared to theoretical predictions in order to evaluate the shift measurement as a diagnostic method to measure electron density. Author

N66-21748# Michigan Univ., Ann Arbor. Electron Physics Lab.
MICROWAVE PHENOMENA Interim Scientific Report No. 4, 1 Jun.–1 Dec. 1965
G. I. Haddad, G. T. Konrad, R. J. Lomax, and J. E. Rowe Dec. 1965 150 p refs
(Contract AF 33(615)-1553)
(Rept.-06349-11-S; AD-627673)

Contents: Relativistic electron beam interactions cold-cathode plasmas; radiation from solids; instabilities in solids; traveling-wave parametric amplifiers and voltage-tunable circuits; stimulated emission of radiation studies; millimeter- and submillimeter-wave detectors. TAB

N66-21771*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
TRANSMISSION AND REFLECTION OF ELECTROMAGNETIC WAVES NORMALLY INCIDENT ON A WARM PLASMA
Craig Comstock [1965] 30 p refs
(Grant NsG-134-61)
(NASA-CR-71404) CFSTI: HC $2.00/MF $0.50 CSCL 20I

The solution for an electric field normally incident onto a warm, semi-infinite plasma is obtained by means of a modified Wiener–Hopf technique. The warm plasma is taken into

account by means of the relativistic Vlasov equation. It is found that the previously obtained solution of Taylor gives the correct term for the wave number in the plasma, but not the correct answer for the field. It is shown that the method of considering an equivalent fully infinite plasma corresponds to a physically unrealistic matching of the plasma to the vacuum. The field inside the plasma is found. The field just inside the plasma is discussed and the non-uniform limit from warm to cold plasma found by Taylor is not found in our solution. Author

N66-21805# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ION CYCLOTRON RESONANCE HEATING OF AN INHOMOGENEOUS PLASMA COLUMN
Masatoshi Tanaka Sep. 1965 36 p refs
(IPPJ-37) CFSTI: HC $2.00/MF $0.50

The ion cyclotron wave is generated in a plasma by an induction coil (Stix-type coil) wrapped around the plasma column. The absorbed rf power spectrum is estimated on the basis of the linearized Vlasov–Maxwell equations by taking into account of the variations of plasma density and ion temperature over the cross section of the plasma cylinder. Numerical calculations are made for the values of parameters of the QP plasma experiment assuming the density distribution of a parabolic type. Author

N66-21865# Aktiebolaget Atomenergi, Stockholm (Sweden).
A PARAMETRIC STUDY OF A CONSTANT-MACH-NUMBER MHD GENERATOR WITH NUCLEAR IONIZATION
J. Braun 1965 29 p refs
(AE-173) CFSTI: HC $2.00/MF $0.50

The influence of electrical and gas dynamical parameters on the length of a linear constant-Mach-number MHD duct has been investigated. The gas has been assumed to be ionized by neutron irradiation in the expansion nozzle preceding the MHD duct. Inside the duct the electron recombination is assumed to be governed by volume recombination. It is found that there exists a distinct domain from which the parameters must be chosen, pressure and Mach number being the most critical ones. If power densities in the order of magnitude 100 MW/m^3 are desired, high magnetic fields and Mach numbers in the supersonic range are needed. The influence of the variation of critical parameters on the channel length is given as a product of simple functions, each containing one parameter. Author

N66-21892# United Aircraft Corp., East Hartford, Conn. Research Labs.
EFFECTS OF INERT GAS OVERPRESSURE ON ARC CHARACTERISTICS
R. H. Bullis, W. J. Wiegand, and D. W. Bell [1965] 9 p refs Presented at the 25th Annual Conf. on Phys. Electron., Cambridge, Mass., 24–26 Mar. 1965
(Contract AF 49(638)-1221)
(AFOSR-65-2500; AD-628024) CFSTI: HC $1.00/MF $0.50

To determine the effect of the presence of an inert gas on the properties of the non-equilibrium cesium plasma which exists in the interelectrode space of an arc-mode thermionic converter, detailed electrostatic probe measurements have been made of electron temperature, electron number density, and the plasma potential over a wide range of inert gas pressures. By employing electrostatic probe techniques to measure the properties of the non-equilibrium cesium plasma, direct assessment has been made of the effects of an overpressure of inert gas on the plasma properties without having to include extraneous effects such as changes in the work functions of the emitter and collector produced by the interaction of the inert gas with these surfaces. In addition, spectroscopic measurements have been made to determine the behavior of the atomic and molecular excited state populations with changes in inert gas pressure, converter output and maximum electron density in the neutralization plasma. The range of inert gas pressure over which volume ionization processes can be sustained in the non-equilibrium neutralization plasma in the converter with argon used as the inert gas has been determined from these measurements. Author (TAB)

N66-21911# Utah Univ., Salt Lake City. Upper Air Research Labs.
RF PROBE TECHNIQUES FOR IONOSPHERIC MEASUREMENTS Final Report, 1 Jun. 1964–31 May 1965
K. D. Baker, A. M. Despain, and J. C. Ulwick Dec. 1965 35 p refs
(Contract AF 19(628)-447)
(AFCRL-65-767; AD-62815) CFSTI: HC $3.60/MF $0.50

Three radio frequency (rf) probe techniques—Standing Wave Impedance Probe, Plasma Frequency Probe, and Resonance Rectification Probe—have been simultaneously flown on rockets for ionospheric measurements. The results of the three probes are compared to establish the relationships between them. The Impedance Probe and Plasma Frequency Probe measurements are in general agreement with each other and with other independent measurements. A model of antenna-ionospheric interaction is used which neglects ion sheath and magnetic field effects. The Resonance Rectification Probe shows resonance effects including peaks and minima which are a function of probe dc bias. The frequency of the dominant resonance peak does not correspond to the plasma frequency, but is near a lower frequency of an impedance series resonance as measured by the Plasma Frequency Probe. Author (TAB)

N66-21912# Minnesota Univ., Minneapolis. Heat Transfer Lab.
AN ANODE COMPARISON STUDY IN A WALL-STABILIZED ARGON ARC Interim Technical Report
E. Pfender, G. D. Raithby, and E. R. G. Eckert Wright-Patterson AFB, Ohio, ARL, Nov. 1965 98 p refs
(Contract AF 33(657)-7380)
(ARL-65-232; AD-628613) CFSTI: HC $9.60/MF $0.75

Experiments were conducted to determine whether or not transpiration cooling the anode of a cascaded, wall-stabilized argon arc could substantially reduce the net power loss to the anode. A water-cooled copper anode and a geometrically similar porous graphite transpiration-cooled anode were used to make a direct comparison of the power losses. In addition, complete heat balances of the arc using both anode types were made. These measurements gave the losses to the other apparatus components. From these measurements and a proposed model for the energy transfer to the anode, anode fall values were calculated for the case of the water-cooled anode. In addition, the contribution of the various modes of energy transfer to the anode were determined. Heat flux measurements to the segmented constrictor tube were used to determine the local radiation and conduction to the wall. Also measurements were made of the arc voltage–current characteristics and the voltage distribution along the plasma column from which the field strength can be determined. Author (TAB)

N66-21917# ARO, Inc., Arnold Air Force Station, Tenn.
IONIZATION AND RECOMBINATION IN ALKALI-SEEDED COLLISION-DOMINATED PLASMAS
B. P. Curry Arnold Eng. Develop. Center, Feb. 1966 50 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-65-260; AD-627988) CFSTI: HC $2.00/MF $0.50

At electron densities greater than 10^{12}/cc, ionization and recombination proceed predominantly by sequential transitions between adjacent energy levels induced by collisions with free electrons. Similar models for this process have been developed by various investigators. This report develops closed-form expressions for ionization and recombination of effective one-electron atoms by modifying the Byron model and determining analytically the critical energy level in equilibrium with the free electrons, using a simplified quantum mechanical model of the alkali atoms. The reaction rate coefficients calculated from these expressions agree satisfactorily with available experimental data and with numerical calculations of other investigators. Author (TAB)

N66-21920# Maryland Univ., College Park.
A CRITICAL SURVEY OF MAGNETOFLUID DYNAMICS. PART III: QUASI-ONE DIMENSIONAL ANALYSIS OF MAGNETOGAS DYNAMICS
Shih-I Pai Wright-Patterson AFB, Ohio, ARL, Dec. 1965 66 p refs
(Contract AF 33(657)-7805)
(ARL-63-175, Pt. III; AD-627935) CFSTI: HC $3.00/MF $0.75

A critical survey is presented of the flow of an ionized gas in a channel under the influence of transverse electro-magnetic fields. First, the exact quasi-one dimensional equations of magneto-gas dynamics are derived. The importance of the various covariance coefficients is pointed out. In the literature, only the cases with covariance coefficients of unity have been reported. A survey of these cases has been made which includes (1) inviscid steady flow, (2) steady flow of viscous and heat-conducting fluid and (3) unsteady flow. Finally, we summarize our present knowledge of quasione dimensional flow of magneto-gas dynamics and make some recommendations for future research. Author (TAB)

N66-21924# Naval Weapons Lab., Dahlgren, Va.
ON MAGNETOHYDRODYNAMICS OF ROTATING FLUIDS
Ernst W. Schwiderski and Hans J. Lugt Dec. 1965 72 p refs
(NWL-1962; AD-627919) CFSTI: HC $3.00/MF $0.75

The influence of rather general electromagnetic forces acting upon steady rotating motions of conducting viscous incompressible fluids over a rotating disk is investigated by means of adjustable local boundary layer approximations of first order. Numerical results for the most important motions of von Karman and Bodewadt are displayed and discussed in full detail. The hypothesis of small variations of the imposed magnetic field assumed in other investigations is found to be justified provided the corresponding Hartmann number and magnetic Reynolds number are of sufficiently small magnitude. Considerable distortions of the rotating motions result from strong electromagnetic forces. When the strength of the imposed electromagnetic forces is increased, the secondary motions may change their stagnation character to wake character, and vice verse. In addition to critical Reynolds numbers critical Hartmann numbers and magnetic Reynolds numbers are shown to exist beyond which no simple boundary-layer-type motions are possible. The interpretation of the spacial instabilities of wake-type flows as a separation phenomenon is supported by the 'tea-cup' experiment photographed. Author (TAB)

N66-22005# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
STUDIES OF HIGH-CURRENT METALLIC ARCS
Floyd W. Wood and Robert A. Beall [1965] 90 p refs
(Contract AT-(11-1)-140)
(BM-Bull.-625; TID-22125) GPO: $0.75

Original experimentation in specially designed arc-melting furnaces and a comprehensive review of technical literature have helped with an understanding of electric arcs as used in metallurgical applications. Results relevant to the distribution of electric potentials and currents, temperatures, pressures, the consumption of electrodes, the identities of particles participating in electrical conduction, and the modes and mechanisms of discharge are presented and discussed. Present knowledge of high-current arcs is insufficient to test pertinent theoretical suggestions. However, the chief doubts concern the identities and the liberation or formation of current-carrying particles. It seems that either novel formulations of existing concepts are needed, or essentially new concepts must be recognized to explain observations. An analysis of the situation leads one to favor the latter possibility and to suggest the existence of supplementary conducting particles. The conduction of current by the streaming of charged agglomerates is postulated. Another outgrowth of analysis is an equation for the arc potential as a function of current densities in the arc. In lieu of conclusions, the potentialities of practical applications and specific needs for fundamental clarification are summarized. Author (NSA)

N66-22061# Texas Univ., Austin. Plasma Physics Lab.
RADIOFREQUENCY PLASMAS AT THE HYBRID ION-ELECTRON RESONANCE
H. Schlueter and C. J. Ransom Jan. 1965 46 p refs
(Contract AT(40-1)-3110)
(TID-21783) CFSTI: HC $2.00/MF $0.50

For wave propagation perpendicular to the static magnetic field of plasmas, a resonance expected at the geometrical mean of the ion and electron cyclotron frequency is large compared to the electron cyclotron frequency. At this resonance, the so-called hybrid ion-electron resonance, the resistive impedance for an external power source has a minimum. Corresponding extrema in the loading of a steady state 10 kw oscillator are observed, virtually at the geometrical mean frequency. The observations are made in hydrogen, deuterium, and helium radio frequency plasmas for different oscillator frequencies from 13 to 30 Mc/sec and gas pressures from 5×10^{-3} to 6×10^{-2} mm Hg. The density condition for the occurrence of the hybrid resonance is fulfilled as spectroscopic, microwave, and probe density measurements show.
Author (NSA)

N66-22148# Los Alamos Scientific Lab., N. Mex.
A MEASUREMENT OF THE ELECTRON DENSITY OF THE DENSE PLASMA FOCUS BY SCHLIEREN PHOTOGRAPHY

J. W. Mather 13 Aug. 1965 10 p
(Contract W-7405-ENG-36)
(LA-3334) CFSTI: HC $1.00/MF $0.50

The Schlieren method employing a pinhole aperture is used to determine the electron density of a dense plasma. An expression is derived for the mean angular divergence $\langle\theta\rangle$ of a parallel light beam in terms of the refractive index, the gradient of refractivity, and the boundary shape factor of the plasma. This calculation is applied to the dense plasma focus experiment for a specific electron density distribution and plasma shape. The Schlieren method gives a least value of 10^{19}/cc, in good agreement with other independent measurements (2×10^{19}/cc). Author (NSA)

N66-22150# Laboratoire de Recherches sur la Physique des Plasmas, Lausanne (Switzerland).
MEASUREMENT OF TRANSITION PROBABILITIES OF SOME IONIZED ELEMENTS: CONSTRUCTION OF THE EXPERIMENT [MESURE DES PROBABILITIES DE TRANSITION DE QUELQUES ELEMENTS IONISES: CONSTRUCTION DE L'EXPERIENCE]
J. Durand Apr. 1965 23 p refs In FRENCH; ENGLISH summary
(LPR-16-65)

An arc of 0.5 msec duration, the current of which can reach 10,000 amp., is described. The arc plasma is in thermal equilibrium: the temperature reaches 30,000 to 40,000°K. The density is of the order of 10^{16} cm^{-3}. The transition probabilities of the lines emitted by the arc are measured with the described spectroscopic device. Finally, the possibility is shown of measuring currents of 10^4 amp and more with a shunt, even if the frequency reaches several MHz.
Author (NSA)

N66-22229*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTS ON ION-CYCLOTRON-WAVE GENERATION USING AN ELECTROSTATICALLY-SHIELDED RF COIL
C. C. Swett, R. Krawec, G. M. Prok, and H. J. Hettel Washington, NASA, 1965 19 p refs Presented at the Am. Phys. Soc. Meeting, Washington, D. C., 26-29 Apr. 1965
(NASA-TM-X-52091) CFSTI: HC $1.00/MF $0.50 CSCL 20I

Power absortption by a hydrogen plasma was investigated using an electrostatically shielded Stix-type rf coil in a continuously operating apparatus. The additional capacitance added to the system by the shield caused the rf vacuum magnetic field of the coil to be spatially nonsinusoidal in the axial direction. A Fourier analysis of the observed field distribution indicates that the coil system generates waves of 44.5- and 89.0-cm wavelengths instead of the single 40-cm wavelength it was designed to produce. Two peaks were observed in power absorption near the atomic-ion-cyclotron field. These peaks are attributed to the two waves generated by the coil system rather than one wave plus a particle resonance, which was the previous interpretation. It is suggested that similar distortions of the sinusoidal field may be produced even in unshielded experiments because of the capacitance between the coils and the generated plasma. Author

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N66-21112# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
SILICON CARBIDE EPITAXIAL TECHNIQUES Scientific Report No. 1, 1 Feb.-31 Aug. 1965
Don M. Jackson and Bernard Van Pul 15 Oct. 1965 127 p refs
(Contract AF 19(628)-4802)
(AFCRL-65-837; AD-626729) CFSTI: HC $4.00/MF $0.75

Epitaxial silicon carbide (SiC) films were grown on silicon (Si) by the simultaneous vapor phase deposition of silicon from silicon tetrachloride or silane and carbon from propane or isobutylene. The reaction temperatures were in the range of 1000° to 1300°C (pyrometer). The resultant films were extensively examined by electron diffraction and transmission electron microscopy and found to be, for the most part, single crystal beta-SiC with some polycrystalline inclusions of the alpha SiC phase. Structurally, the films do not compare with high quality silicon or germanium. The <100> substrate orientation was found to be a better surface for the growth of beta-SiC than the (111) orientation. The optimum temperature range for film growth was found to be from 1000°C to 1100°C (pyrometer). Low energy electron diffraction studies were not conclusive due to difficulty met in annealing the films. Attempts at growing SiC p-n junctions were not successful, although rectifying junctions were fabricated using n-type films on p-type Si substrates. Most problems appear to be in the difficulty of obtaining definite p-type SiC layers. Author (TAB)

N66-21193# Norwegian Defence Research Establishment, Kjeller.
SPACE CHARGE WAVES IN A SEMICONDUCTOR PLASMA Scientific Report No. 10
Kjell A. Ingebrigtsen 11 Nov. 1964 20 p refs
(Contract AF 61(052)-484)
(E-46; AFCRL-65-773; AD-626197) CFSTI: HC $1.00/MF $0.50

An expression for the impedance of a recombinating semiconductor plasma in presence of static electric and magnetic fields is developed. This general expression is specialized to detailed discussions of the cases where the static electric and magnetic fields are parallel and perpendicular respectively. Recombinations are accounted for only when the magnetic field is zero and when the direction of propagation is parallel to the static electric field, otherwise it is neglected. Author (TAB)

N66-21228# International Business Machines Corp., Yorktown Heights, N. Y. Thomas J. Watson Research Center.
MICROWAVE OSCILLATIONS IN BULK SEMICONDUCTORS First Quarterly Progress Report, 1 Jul-30 Sep. 1965
N. Braslau, J. M. Woodall, and T. S. Plaskett Jan. 1966 47 p refs *Its* Rept.-1
(Contract DA-28-043-AMC-01550(E); ARPA Order 662 Proj. Defender)
(ECOM-01550-1; AD-626829) CFSTI: HC $2.00/MF $0.50

The state of development of Gunn effect devices as of the summer of 1965 is reviewed. N-type Gallium Arsenide with resistivity of 10–100 ohm cm was obtained by the heat treatment of semi-insulating material and the results of preliminary investigation of this material are included. Attempts to make satisfactory ohmic contacts to this material have so far been unsuccessful. The results of several diagnostic experiments on Gunn effect oscillators made of this and lower resistivity materials are presented. Author

N66-21293# Army Electronics Labs., Fort Monmouth, N. J.
HIGH-POWER GALLIUM ARSENIDE LASER DIODES
L. Wandinger and K. L. Klohn Oct. 1965 24 p refs
(ECOM-2629; AD-627084) CFSTI: HC $1.00/MF $0.50

The essential features in the design, development, and performance of GaAs p-n junction laser diodes with high output in the coherent beam for application in secure communication systems are discussed. After a brief review of device design principles, the technology of wafer preparation, diffusion of extremely planar p-n junctions and the formation of ohmic, low resistance, area contacts developed at this Command is presented. Measurement techniques to determine the performance characteristics of these lasers such as threshold current density, output power, external quantum efficiency, spectral distribution and linewidth of emitted radiation are discussed. Experimental units with a total average power output in the coherent beam of more than three watts corresponding to a quantum efficiency of 15 percent have been made. Author (TAB)

N66-21296# Illinois Univ., Urbana. Dept. of Physics.
A STUDY OF IRON IMPURITY IN SILVER CHLORIDE USING MAINLY THE MOSSBAUER EFFECT
D. H. Lindley and P. G. Debrunner [1965] 43 p refs
(Contracts AT(11-1)-1198; Nonr-1834(05))
(COO-1198-330; AD-627180) CFSTI: HC $2.00/MF $0.50

The Mossbauer effect was investigated as a function of temperature between 4°K and 550°K for sources of Cobalt-57 impurity diffused into single crystal silver chloride. Auxiliary measurements of ionic conductivity, optical absorption, E.S.R. and dielectric dispersion were also made. The Mossbauer spectrum of a freshly prepared sample is attributed to a ferrous ion in a substitutional site bound to a positive ion vacancy in a unique (100) position. Between 4°K and 230°K a simple quadrupole doublet is observed which is interpreted to show a measure of covalency in the ferrous ion. Above 230°K the spectral lines broaden and the spectrum collapses to a single line; it is proposed that this effect is a result of the thermal motion of the vacancy around the impurity. The deduced vacancy jump times are shown to agree with those derived from dielectric dispersion measurements. Aged samples have complex Mossbauer spectra which are explained by the formation of additional centers of ferrous ions bound to anion impurities. Author (TAB)

N66-21309# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
GROWTH AND CHARACTERIZATION OF SINGLE CRYSTALS OF RARE EARTH COMPOUNDS Quarterly Technical Report
31 Jan. 1966 6 p
(Contract AF 49(638)-1245; ARPA Order-447)
(QTR-10; AD-626865) CFSTI: HC $1.00/MF $0.50

Magnetization measurements were made on the GdNd alloys to ascertain the mode of the spin coupling between a heavy and a light rare earth atom. The magnetic data have substantiated the ferromagnetic spin coupling assumed in the Dekker theory of electrical resistivity of the rare earth alloys. It was further disclosed in a scientific paper that the Dekker theory is inapplicable to approximately half of the possible intra-rare earth alloys. Its failure reflects a lack of understanding of the light rare earth ions. A remedy of the theory necessitates a major change of the analysis basing on the actual energy-level structure of these ions, which is not known at the present time. Low-temperature resistivities were determined of several Pd alloys containing solute atoms of Gd, Rh, and Fe. The electrical data have reconfirmed the absence of the abnormally large spin-polarization effect of the localized moments of the Fe atoms in Pd. Experimental efforts were made to explore the possible occurrence of resistance minimum in the Pd-Gd alloys. The effect of local modes at the impurity centers was examined upon the scattering of electrons in aluminum between 4.2° and 300°K.
Author (TAB)

N66-21334# General Electric Co., Schenectady, N. Y. Research and Development Center.
NEW SOLID-STATE DEVICE CONCEPTS Scientific Report No. 3
M. Aven, R. N. Hall, L. M. Rosenberg, and H. H. Woodbury Dec. 1965 42 p refs *Its* Rept.-65-GC-0319
(Contract AF 19(628)-4976)
(AFCRL-65-896; AD-628770) CFSTI: HC $4.60/MF $0.50

Data on the diffusion of Se into CdS as functions of time and sulfur pressure between 900 and 1000°C show that the diffusion profiles are independent of predoping with Se, preannealing the crystals, surface preparation, and in doping. The diffusion is not simple, and the data are being analyzed to determine a suitable model. A successful new technique for growing $ZnSe_xTe_{1-x}$ crystals is described, and data on the properties of junctions prepared from a new composition corresponding to x=0.14 are given. Light intensity vs current and temperature are given and discussed in terms of a proposed energy level diagram. Thin-film GaAs switching diodes have been constructed by evaporation of Ga and As onto Mo substrates. The characteristics resemble those described by Mizushima except that they are asymmetrical with respect to voltage. Author (TAB)

N66-21348# Clevite Corp., Cleveland, Ohio. Electronic Research Div.
RESEARCH ON II–VI COMPOUND SEMICONDUCTORS Quarterly Report, 1 Jul.–30 Sep. 1964
L. R. Shiozawa, J. M. Jost, and S. S. Devlin 30 Nov. 1964 25 p refs
(Contract AF 33(657)-7399)
(QR-11; AD-627381) CFSTI: HC $1.00/MF $0.50

Purification of CdS by vacuum sublimation has resulted in more consistant yields of bright yellow single crystals having near intrinsic low-temperature electron mobility. The low-angle grain-boundaries present in seed-grown crystals was traced to surface damage on the seeds. Deep etching of seeds has eliminated this problem. Efforts to reduce the amount of SiO_2 inclusion have resulted in only minor improvements. The formation of screw dislocations was traced to the SiO_2 particles. The thermally stimulated 'tap effect' in CdS was investigated and is shown to be an electroluminescent effect which results from the pyroelectric nature of CdS. Room temperature edge emission in CdS was obtained when a crystal contained in an evacuated tube was excited by a high voltage, high frequency discharge on the outside of the tube. The

experimental Hall mobility of CdSe is compared with the complete theory and results indicate that these crystals are only weakly compensated. Author (TAB)

N66-21444# Delaware Univ., Newark. Dept. of Physics.
PRODUCTION AND ANNEALING OF X-RAY AND THERMAL DAMAGE IN CdS SINGLE CRYSTALS
Karl W. Böer, Joseph C. O'Connell, and Charles A. Kennedy Feb. 1966 14 p refs
(Contract Nonr-4336(00))
(TR-5; AD-628022) CFSTI: HC $1.00/MF $0.50

Changes in the defect structure of 'pure' single-crystal platelets of CdS in ultrahigh vacuo (10^{-10} Torr) have been produced by 300-keV X-rays and by 'freezing-in' of defects caused by heat treatment in vacuo at temperatures between 100 −350°C. The changes were studied by means of the spectral distribution of photocurrent and T.S.C. curves. In both cases, these defects could be annihilated by annealing and the crystals essentially returned to their pretreated states. These reversible changes are discussed in terms of intrinsic defects. After a number of treatment-annealing cycles, the crystals show a small additional change in their electrical properties, which are explainable in terms of memory effect in the case of radiation damage and of desorption from the surface in the case of heat treatments. Author (TAB)

N66-21464# Rome Air Development Center, Griffiss AFB, N. Y. Reliability Branch.
SEMICONDUCTOR RELIABILITY—THE CORRELATION OF EXCESS NOISE WITH DELETERIOUS SURFACE PHENOMENA Final Report
Edgar A. Doyle, Jr., Jack S. Smith, and Gerald G. Sweet Dec. 1965 83 p refs
(RADC-TR-65-379; AD-627891) CFSTI: HC $3.00/MF $0.75

The properties of l/f (excess) noise present in semiconductor p-n junctions under normal operating conditions, including noise voltage, frequency dependence, noise frequency exponent alpha, and the noise voltage-reverse leakage current proportionality constant K', are described. Variations in these excess noise parameters, when the semiconductor surface is subjected to various external ambients, have been demonstrated and indicate that excess noise in semiconductor devices can be associated with the surface in general and, more specifically, with surface inversion layer or channel formation. Techniques employed in excess noise measurements and for detecting semiconductor surface inversion are described. The applicability of gross excess noise voltage, noise frequency exponent alpha, and the noise proportionality constant (K') measurements for use as a reliability screening technique is discussed. Author (TAB)

N66-21474# Rensselaer Polytechnic Inst., Troy, N. Y.
INVESTIGATION OF TRANSIENT RADIATION DAMAGE IN SEMICONDUCTOR MATERIALS Quarterly Progress Report, 1 Feb.-30 Apr. 1965
Roland M. Lichtenstein, H. James Willard, Jr., John C. Corelli, A. Robb Frederickson, and James W. Westhead [1965] 31 p refs
(Contract DA-36-039-AMC-02165(E))
(QPR-9; AD-627392) CFSTI: HC $2.00/MF $0.50

Tests for transient radiation damage in 6300 ohm-cm, 600 ohm-cm and 27 ohm-cm p-type silicon were made using a photoconductivity method reported previously. It was found that transient effects exist at 600 μsec following the electron pulse in the 600 ohm-cm sample. No effect was observed for the 6300 ohm-cm sample after 600 μsec, and the results for the 27 ohm-cm sample were inconclusive. The behavior of medium resistivity n- and p-type silicon during and immediately after irradiation by approximately 48 MeV electron pulses was investigated. Irradiations were performed at temperatures from 80°K–300°K. The more general results observed are: (1) the long tail decay of the conductivity pulse increases with both pulse size and total exposure on n-type material, but there is no long tail in p-type silicon; (2) saturation time increases nonlinearly with pulse size; (3) response curve shapes vary greatly with temperature. A low-noise system is described which is used in this study of transient radiation effects in silicon. The system allows conductivity and Hall effect voltage transients to be measured on bridge-type silicon samples. A cryostat incorporated in the system allows the sample to be irradiated at any temperature from 100°K to 350°K. Tests of the equipment were run with the RPI Linac and show that noise signals can be reduced to 100 μsec V. Author (TAB)

N66-21498# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THE MAGNETIC SCATTERING OF NEUTRONS BY NICKEL
Herbert A. Mook, Jr. Nov. 1965 98 p refs
(Contract ARPA SD-88)
(ARPA-17; AD-627302) CFSTI: HC $3.00/MF $0.75

By using the neutron as a probe, precise information can be obtained about the spatial distribution of the magnetic moment density in a ferromagnet that is quite free of theoretical approximations. By comparison of the measured form factors with free atom form factors, and by direct calculation of the magnetic moment density from the measured neutron data, it was found that the magnetic moment distribution in iron and cobalt agreed with a model of the magnetization that imposed free atom-like distributions on a constant negative background. It was also discovered that the magnetic moment density was quite asymmetric about the nuclei in iron but almost spherical in cobalt. It was apparent that it would be valuable to know distribution of the magnetic moment density in nickel so that it could be compared with that of iron and cobalt. The magnetic scattering amplitude for nickel was determined for the first 27 Bragg reflections. The magnetic form factor was Fourier transformed to give a three-dimensional map of the magnetic moment density directly from the measured data. The map shows clearly the asymmetry in the magnetic moment distribution. TAB

N66-21528 Nebraska Univ., Lincoln. Dept. of Electrical Engineering.
PHENOMENA IN DISCONTINUOUS METAL FILMS
N. M. Bashara *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 8–11 refs (See N66-21526 11-09)
CFSTI: HC $6.00/MF $1.50

Some of the phenomena in metal films which have an island structure are discussed. Saturation in conductance in high electric fields is considered, and it is concluded that carriers may move rather easily at room temperature from one island to another. The electron emission at room temperature, which is associated with low work function, is also discussed; as is the greater conduction in a metal–dielectric-metal sandwich when the positive electrode has an island structure. M.W.R.

N66-21529 Carnegie Inst. of Tech., Pittsburgh, Pa.
BASIC MATERIALS RESEARCH AS A FOUNDATION FOR MICROELECTRONICS
R. L. Longini *In* ONR Third Conf. on the Navy Microelectron. Program [1965] p 12–15 (See N66-21526 11-09) CFSTI: HC $6.00/MF $1.50

The direct effect of dislocations on noises is under investigation, as is an attempt to determine the conditions under which the noise is produced and what can be done to minimize it. Surface structure, such as chemical composition of coatings, appears to play a role in the noise and the stability of the surface itself. Materials research is considered essential for further developments in microelectronics, which will provide systems which will be more stable, have lower noise levels, and operate at lower power. M.W.R.

N66-21656*# Martin Corp., Baltimore, Md. RIAS Div.
STUDY OF ELECTRON–PHONON INTERACTION IN III–V SEMICONDUCTORS Quarterly Progress Report No. 4, 15 Oct. 1965–15 Jan. 1966
Joseph Martin 3 Feb. 1966 14 p refs
(Contract NAS8-20012)
(NASA-CR-71395) CFSTI: HC $1.00/MF $0.50 CSCL 20L

Temperature variation of attenuation in tourmaline and quartz was measured, and InSb was prepared with a rod from InSb crystal in connection with experimental investigations of the electron–phonon interaction in III to V semiconductors. Both the tourmaline and quartz exhibited an approximate T^7 dependence at low attenuation levels; below 35°K quartz attenuation is lower than that of tourmaline, but at higher temperatures tourmaline attenuation is lower. Attenuation measurements are also reported for 10mc acoustic waves down to 77°K for InSb and down to 4°K for GaAs. M.W.R.

N66-21686*# National Aeronautics and Space Administration, Washington, D. C.
DEACTIVATION AND ACTIVATION OF IMPURITIES IN SILICON [DEZAKTIVATSIIA I AKTIVATSIIA DOMISHOK V KREMNII]
K. D. Glinchuk and N. M. Litovchenko Feb. 1966 14 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 10, no. 2, 1965 p 172–177
(NASA-TT-F-9891) CFSTI: HC $1.00/MF $0.50 CSCL 20L

Investigation of the effect of annealing in the range from 800° to 1200°C on the electrical behavior of impurity atoms of Au, Zn, Pt, S, and Fe in silicon semiconductors. Annealing at 800°C is found to make such impurities inactive, suppressing their effects on silicon photoconductivity and electron and hole concentrations. The effects are restored by annealing at 1200°C. Changes in solubility of these impurities in silicon and shifts in their diffusion direction at different temperatures are seen to be major factors in the mechanism of the phenomenon. Author

N66-21752# Massachusetts Inst. of Tech., Cambridge. Metals Processing Lab.
THE TEMPERATURE VARIATION OF THE GINZBURG–LANDAU PARAMETER IN NIOBIUM SINGLE CRYSTALS
Loren C. Skinner, II Jan. 1966 50 p refs
(Contract Nonr-3963(16))
(TR-1; AD-627910)

Magnetization measurements were made on high purity Nb single crystals at temperature from 1.6° to 8.8°K. The crystals were grown by the electron beam floating-zone technique and had resistivity ratios from 100 to 800. The upper and lower critical fields H_{c2}-H_{c1} and the slope of the magnetization curve at the upper critical field, H_{c2}, were determined. The value of H_{c2} and the slope at H_{c2} require two separate phenomenological parameters, as has been predicted by the Maki-Tsuzuki linear approximation. The temperature dependence of the slope at H_{c2} is best described by the Maki-Tsuzuki theory, but the temperature variation of H_{c2} is best described by the Ginzburg-Bardeen theory. Author (TAB)

N66-21776*# Field Emission Corp., McMinnville, Oreg.
INVESTIGATIONS OF ELECTRON EMISSION CHARACTERISTICS OF LOW WORK FUNCTION SURFACES Quarterly Report No. 5, 1 Oct.–31 Dec. 1965
L. W. Swanson, A. E. Bell, and L. C. Crouser Jan. 1966 28 p refs
(Contract NASw-1082)
(NASA-CR-71539) CFSTI: HC $2.00/MF $0.50 CSCL 20L

A fixed orientation probe tube has been used to investigate work function change caused by localized adsorption of cesium on tungsten. Desorption in the presence of an applied electric field provided a nearly uniform coverage over the emitting area of the tip without necessitating equilibration. A new versatile probe tube has been constructed and its associated experimental program is described in this report. More refined energy distribution and work function measurements on the (310) plane are reported. The results indicate reasonably close agreement between experiment and theory. A measurement of I-V characteristics along various (310) directions enabled us to obtain information regarding the variation of field and linear magnification with emitter apex angle. Author

N66-21834# Air Force Cambridge Research Labs., Bedford, Mass. Solid State Sciences Lab.
A STUDY OF BAND EDGE DISTORTION IN HEAVILY DOPED GERMANIUM
Freeman D. Shepherd, Jr. (M.S. Thesis–Northeastern Univ.) Oct. 1965 91 p refs *Its* Phys. Sci. Res. Paper No. 150 (AFCRL-65-735; AD-627003) CFSTI: HC $3.00/MF $0.75

Details of the energy band structure of degenerate n-type germanium were determined by analysis of fine structure in the 4.2 K volt-ampere characteristic of germanium tunnel diodes. No shift in the relative energy of the conduction band minima was observed. The band edge is found to be exponentially distributed with 1/e energies of the order of 10 MeV. There appears to be an ordering mechanism among the group V impurity atoms used as substrate dopants. Author (TAB)

N66-21886# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
JOINT SERVICES ELECTRONICS PROGRAM Final Report, 1 Sep. 1964–31 Aug. 1965
[1965] 110 p refs
(Grant AF-AFOSR-496-65)
(AFOSR-65-2648; AD-628025) CFSTI: HC $4.00/MF $0.75

Research efforts are summarized in the major categories of solid state electronics, electromagnetics and plasmas, and information sciences. These major categories include investigations and experiments in such related areas as semiconductors, magnetism, imperfection in crystals, superconductivity, control systems, computers, and coding theory. C.T.C.

N66-21903# Pennsylvania State Univ., University Park. Materials Research Lab.
CRYSTAL CHEMISTRY STUDIES Quarterly Report, 13 Aug.–13 Nov. 1965
Rustum Roy, S. Kachi, G. J. Mc Carthy, O. Muller, and William B. White Jan. 1966 34 p refs
(Contract DA-28-043-AMC-01304(E))
(QR-2; AD-627468) CFSTI: HC $2.00/MF $0.50

Research has been concerned with (1) the study of the crystal chemistry of a series of rare earth-rhenium oxide compounds. Six new phases have been found and identified by X-ray and electron probe analysis: (2) study of the binary system V-O has been completed and described in a Technical Report 'Phase Equilibrium Studies and Transitions in the System V_2O_3–V_2O_5. Five out of seven intermediate stable phases found behave like antiferromagnetic materials, having different Neel points; (3) Work has continued to synthesize SmO and EuO. Methods such as reduction of the sesquioxides, oxidation of the metals and reaction of the metal with the sesquioxides have been tried. So far, SmO has been prepared successfully only by the latter method. Author (TAB)

N66-21909# Stanford Research Inst., Menlo Park, Calif.
SHOCK ATTENUATION IN SOLID AND DISTENDED MATERIALS Final Report, 1 Aug. 1963–1 Nov. 1965
J. R. Rempel, D. N. Schmidt, J. O. Erkman, and W. M. Isbell Kirtland AFB, N. Mex., AF Weapons Lab., Feb. 1966 162 p refs
(Contract AF 29(601)-6040)
(WL-TR-64-119; AD-628796) CFSTI: HC $5.00/MF $0.75

Good methods exist to estimate shock response of certain elastic-rigid foams at very high pressures when no forerunner is present, and at very low pressures when no locking wave is present. For the intermediate region of pressure (approximately 0.1 to 6 kbar), when both waves are present and of the same order of magnitude, predictions are less reliable and values forecast of pressure in this region based on general theories are too high. From considerations of pressure wave shape it is believed that this anomaly may be related to the porous nature of the foam. The investigation experimentally measured peak pressures transmitted to a steel wall to about 6 kbar, found conditions for double-wave structure, and observed wave shapes produced by impacts carrying momentum densities in the range 0.6 to 30,000 taps in 0.7 to 1.4 g/cc aluminum, 0.67 g/cc polyurethane, 1.1 g/cc beryllium, 1.1 to 1.7 g/cc graphite, and 1.0 g/cc silica foam.
Author (TAB)

N66-21919# Army Electronics Labs., Fort Monmouth, N. J.
MICROWAVE PROPERTIES OF ALUMINUM SUBSTITUTED YIG AT LOW TEMPERATURES AS A FUNCTION OF FREQUENCY
Thomas Collins and Isidore Bady Dec. 1965 28 p refs
(ECOM-2649; AD-627523) CFSTI: HC $2.00/MF $0.50

Data is given on the microwave properties of a series of polycrystalline aluminum substituted YIG over the temperature range of −65° C to room temperature. The range of 4 pi Ms is from 200 to 1005 gauss. Each sample was measured at several frequencies over the range where it would normally be used in devices. Thus measurements were made from 450 to 1200 megacycles for the 200 gauss material, and from 1200 to 4000 megacycles for the 1005 gauss material. The data is presented in plots of the ferromagnetic resonance curves, and tabulations of the linewidth, maximum value of the loss component of susceptibility, and biasing fields at which these maximums occurred. Measurements were made using a special coaxial sample holder connected to a coaxial slotted line through a right angle connector. The sample holder was submerged in a liquid bath maintained at the desired temperature. The loss component of susceptibility was calculated from VSWR measurements. The derivation of the formula for calculating the loss term of susceptibility from VSWR, is outlined. TAB

N66-21927# Iowa State Univ. of Science and Technology, Ames.
MEASUREMENT OF PIEZORESISTANCE IN SEMICONDUCTORS
Paul Arthur Temple and G. C. Danielson Nov. 1965 46 p refs
(Contract W-7405-ENG-82)
(IS-1268) CFSTI: HC $2.00/MF $0.50

Apparatus for the measurement of piezoresistance in semiconductors was designed and constructed. A method of stressing the sample using gas pressure applied across a bellows was incorporated. This method of stressing made it possible to vary the stress applied to the sample without disturbing the sample temperature. The linear combination of the piezoresistance tensor components of n-type germanium was measured over the temperature range from 50 to 300°K.
Author (NSA)

N66-21930# Laboratoires du Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
PHYSICAL PROPERTIES OF UO_2 SINGLE CRYSTALS Quarterly Report No. 12, 1 Nov. 1964–31 Mar. 1965
[1965] 26 p refs
(Contract EURATOM-056-64-3 TEEB)
(EUR-2384; EURAEC-1454; R-2354) CFSTI: HC $2.00/MF $0.50

Two independent methods were developed allowing the determination of oxygen self-diffusion in UO_2. The reprecipitation of U_4O_9 after heating in the electron microscope until complete disappearance was studied in further detail. Generally, a much denser set of precipitates was detained after cooling than before heating. Exceptionally the precipitates were observed to precipitate apparently in the same sites as before dissolution. Pulse annealing experiments were performed on quenched UO_{2+x} crystals with compositions slightly exceeding the excess oxygen solubility limit at room temperature. Upon heating at temperatures above 110°C, the oxygen interstitials start migrating and form U_4O_9 precipitates. The activation energy for this migration process was found to be about 0.9±0.1 eV. Several measurements of the thermoelectric power of as-grown and reduced crystals indicate an activation energy for the number of charge carriers of about 0.05–0.08 eV in the temperature range 140–350°K. The magnetic susceptibility of two single crystals of composition $UO_{2.056}$ was measured between 7 and 17 kOe at temperatures between 90 and 300°K. The results are discussed. The thermal conductivity of a second well reduced single crystal was determined in the temperature range 4 to 300°K. Again a maximum in the thermal conductivity (187 mw/°K/cm) is found at 6.2°K. The elastic constants of UO_2 were determined in two different crystallographic directions using a single crystal prepared at Nukem. Combining these results with earlier measurements, a complete set of elastic constants of UO_2 was obtained. (NSA)

N66-21949# Beers (Roland F.), Inc., Alexandria, Va.
STUDIES OF THE PROPERTIES OF THE EQUATION OF STATE FOR SOLIDS Interim Report
June M. Eanet 14 Oct. 1965 119 p refs
(Contract AT(29-2)-1163)
(NVO-1163-60) CFSTI: HC $4.00/MF $0.75

Data relating to the equation of state for solids were obtained in an extensive literary survey. Two populations of materials were used. They are: elements (for a study of basic behavior of simple substances) and geologic materials (those that are to be used in hydrodynamic computations). The equations of state used in the computations for the Hugoniot relations are the Murnaghan equation and the linear velocity relation D = SU + C. Constants were determined for both formulas for each of the materials listed. From the Hugoniots obtained, Gruneisen ratios were calculated at various compression ratios by three different methods. Results of the computations are tabulated. These are followed by listings of input data. Programs used in the computations are listed. NSA

N66-21955# Illinois Univ., Urbana.
ISOTOPIC EFFECTS IN THE LATTICE CONSTANT, THERMAL EXPANSION, AND ISOTHERMAL COMPRESSIBILITY OF NEON SINGLE CRYSTALS
David Neville Batchelder Jul. 1965 118 p refs
(Contract AT(11-1)-1198)
(COO-1198-296)

Single crystals of natural neon and neon of isotopic mass 22 were grown by directional solidification from the liquid. The lattice constant and thermal expansion of these crystals were determined over the range 2.5 to 24.5° K with much greater accuracy than previously reported. The lattice constants extrapolated to 0° C were found to be 4.45453 kX for natural neon and 4.44676 kX for neon-22 with a possible error of ±0.00008 kX. The thermal expansion of neon-22 was slightly larger than that of natural neon crystals. Hydrostatic measurements of the isothermal compressibility of natural neon between 4.2 and 20° K gave an improved value of 0.90×10^{-10} cm^2 $dyne^{-1}$ at 4.2° K, and above 4.2° K, less accurate values which are the first to be reported. The accurate measurements were made possible by the construction of a single-crystal, back-reflection X-ray camera. Contrary to the traditional procedure of mounting the crystal on a small goniometer, the X-ray camera and source were mounted on a very large goniometer. The temperature and pressure of the crystals could then be controlled to ±0.01° K and ±0.5 psi respectively, with the X-ray camera external to the hostile environment (2.5 to 24.5° K and 0 to 120 psi). The results were used to obtain improved values of several thermodynamic functions for neon and neon-22. NSA

N66-21997# Solid State Radiations, Inc., Los Angeles, Calif.
NEW METHOD FOR OXIDE PASSIVATION OF SEMICONDUCTOR DETECTORS Final Report
30 Jul. 1965 17 p refs
(Contract AT(04-3)-574)
(TID-22407) CFSTI: HC $1.00/MF $0.50

The production of silica surface layers on Si semiconductor detectors by immersion in oxygen plasma is reported. The properties of the protective surface layers thus formed under controlled conditions are studied. The results obtained using this method are compared with those obtained using film-deposition and thermal-oxidation processes. NSA

N66-22001# California Inst. of Tech., Pasadena W. M. Keck Lab. of Engineering Materials.
ENERGY LEVEL DIAGRAMS OF OXIDES OF MAGNESIUM, ALUMINUM AND SILICON
K. Das Gupta Oct. 1965 8 p refs AEC Res. and Develop. Rept.-38
(Contract AT(04-3)-221)
(CALT-221-13) CFSTI: HC $1.00/MF $0.50

The distribution of the occupied and unoccupied electron levels of MgO, Al_2O_3, and SiO_2 in solid state was determined by the method of soft X-ray emission and absorption spectroscopy. From the relative positions of the valence emission band and the absorption edge it was concluded that the 2s and 2p wave functions of oxygen ions overlap in these oxides. Tentative energy level diagrams are illustrated showing the allowed and forbidden zones. NSA

N66-22006# Sandia Corp., Albuquerque, N. Mex.
EFFECT OF ASSUMED ELECTRONIC CONFIGURATION ON THE ELECTRONIC BAND STRUCTURE OF NICKEL
E. C. Snow, J. T. Waber (Los Alamos Sci. Lab.), and A. C. Switendick 1 Nov. 1965 10 p refs Presented at Conf. on Magnetism and Magnetic Mater., San Francisco Prepared in cooperation with Los Alamos Sci. Lab.
(Contract AT(29-1)-789)
(CONF-651106-4; SC-DC-65-1843) CFSTI: HC $1.00/MF $0.50

The electronic band structure of nickel is computed by the APW method by using the atomic Dirac-Slater wave functions of the free nickel atom in five configurations of the general type $3d^{10-x}4s^x$. Movement of the d and sp bands relative to each other occurs as a function of x, the assumed number of holes in the d-states. It is shown that if there is a significant difference between the number of s-like electrons in the spin-up and spin-down bands when a magnetic field is applied, the topology of the two Fermi surfaces will be different.
Author (NSA)

N66-22015# Duke Univ., Durham, N. C. Dept. of Electrical Engineering.
CURRENT QUENCHING IN THIN Pb FILMS BY MULTIPLE BOUNDARY PROPAGATION
W. C. Stewart Aug. 1964 25 p refs
(Contract AT(40-1)-2430)
(TID-21307) CFSTI: HC $1.00/MF $0.50

The difficulty of determining whether the thermal propagation process originates at a single site or at numerous sites in thin films having high critical currents and correspondingly high thermal propagation velocities is considered. Switching speed measurements at 4.2° K for 400 to 700 Å thick Pb films of varying lengths show that the initial normal bridges occur in proportion to film length with current pulses higher than about 1.2 I_c. The dependence of transition rate of I/I_c does not vary with thickness in these films. Author (NSA)

N66-22025# Bettis Atomic Power Lab., Pittsburgh, Pa.
ANGULAR VALUES BETWEEN CRYSTALLOGRAPHIC PLANES IN ZIRCONIUM AS USED IN TRANSMISSION ELECTRON MICROSCOPY
O. M. Katz Nov. 1965 20 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-519) CFSTI: HC $1.00/MF $0.50

The angular values between crystallographic planes in zirconium, as used in transmission electron microscopical

studies, are presented for utilization in diffraction pattern analyses due to a recently devised computer program.
Author (NSA)

N66-22028# Duke Univ., Durham, N. C. Dept. of Electrical Engineering.
THE ELECTRICAL CONDUCTIVITY OF THIN-METALLIC FILMS WITH UNLIKE SURFACES
M. S. P. Lucas Oct. 1964 13 p refs
(Contract AT(40-1)-2430)
(TID-21301) CFSTI: HC $1.00/MF $0.50

A theoretical analysis, based on the Fuchs–Sondheimer formalism, is given of the conductivity of single layer, thin metallic films in which the scattering of the conduction electrons is different at each surface. The electron surface scattering is described by the parameters P and Q which represent the fractions of conduction electrons specularly scattered at each surface. Tables of normalized resistivity as a function of thickness divided by mean free path are given for various combinations of P and Q. Author (NSA)

N66-22034# New Mexico Univ., Albuquerque.
PROPAGATION OF ULTRASOUND IN PLASTIC CRYSTALS
Carl E. Scheie (Ph.D. Thesis) 1965 97 p refs
(Contract AT(29-1)-789)
(SC-DC-65-1400) CFSTI: HC $3.00/MF $0.75

Ultrasonic velocity measurements were carried out using the transit-time method in the cubic solids cyclohexanol, cyclohexane, and camphene. The measurements were made above and below the transformation points, and elastic constants were calculated therefrom and used to study the binding in the solids. A nonlinear ultrasonic velocity vs temperature relation was noted for camphene. NSA

N66-22041# Pratt and Whitney Aircraft, Middletown, Conn. Advanced Nuclear Engineering Lab.
THERMAL CONDUCTIVITY AND ELECTRICAL RESISTIVITY OF URANIUM MONOCARBIDE
B. A. Hayes and M. A. De Crescente Oct. 1965 24 p refs
(Contract AT(30-1)-2789)
(PWAC-480) CFSTI: HC $1.00/MF $0.50

The thermal conductivity of 95% dense uranium carbide with 860 ppM oxygen and 520 ppM nitrogen was found to be 0.175 ±0.005 watts/cm-C in the temperature range 1100 to 1600°C. The effect of increasing the combined oxygen and nitrogen impurity level from 1380 to 2180 ppM was minor; however, a general lowering of the thermal conductivity was observed when the impurity level increased from 1380 to 4000 ppM. The portion of the thermal conductivity due to electrons, estimated from electric resistivity data and the Weidemann–Franz relationship, was found to be almost 100% at temperatures above 1000°C. Considerable agreement with previous results was found. A study of all the data indicates that the thermal conductivity of uranium carbide does not vary significantly with temperature in the range 1000° to 2000°C.
Author (NSA)

N66-22065# Vanderbilt Univ., Nashville, Tenn.
OPTICAL CONSTANTS OF EVAPORATED METAL FILMS OF SILVER AND INDIUM
Russell Henry Huebner (M.S. Thesis) Jun. 1965 61 p refs
(TID-21850) CFSTI: HC $3.00/MF $0.75

Optical constants of vacuum-evaporated silver and indium films were determined from reflectance data measured for light incident at 20 and 70°. Values of the real and imaginary parts of the complex index of refraction, n and k respectively, were evaluated by means of a computer program based on Fresnel's equations. The constants for evaporated silver were determined in the wavelength region from 2500 to 3700 Å and were compared with constants evaluated for bulk silver. The real and imaginary parts of the complex dielectric constant and the energy loss function were evaluated for evaporated silver. The constants for silver were obtained to investigate the discrepancy between the experimental optical emission studies from electron-bombarded thin silver foils and the generalized transition radiation theory with the optical constants of bulk silver used as input data. This discrepancy of about 30% in photon intensity at the peak of emission is removed when the constants for evaporated silver are used. Resonance absorption found in the transmission spectra of thin silver films was also investigated, and good agreement was observed between the measured spectra and the theoretical spectra based on Fresnel's equations using the optical constants determined for evaporated silver. Optical constants for evaporated indium were determined in the wavelength region from 1100 to 3000 Å, where no previous data were available. Comparison of optical constants at λ=1100 Å with earlier data obtained in the region $\lambda \leq 1100$ Å showed that values obtained by another worker were approximately 50 percent lower than the values presented here. Such differences in part are attributed to differences in structure of the films prepared in the earlier work and the present. The complex dielectric constant and the energy loss function were determined from the n and k values. These values indicate collective electron oscillation for indium which occurs approximately at λ=1145 Å corresponding to an energy of 10.8 ev. Author (NSA)

N66-22107# Pennsylvania Univ., Philadelphia.
STRAIN-ENHANCED SELF-DIFFUSION IN SILVER
Gordon Lloyd Fisher (Ph.D. Thesis) 1965 157 p refs
(Contract AT(30-1)-1879)
(NYO-10722) CFSTI: HC $5.00/MF $1.00

Silver single crystals were prepared and machined into torsion specimens, and the specimens were plated with ^{110m}Ag tracer. Diffusion anneals were carried out at 550 to 800°C with the specimens under cyclic torsion strain, and the specimens were then sectioned to determine the amount of diffusion. When errors produced by sectioning and surface roughness were taken into account, the enhancement of the self-diffusion coefficient was small, exceeding 100% in only one case. The experiments of Lee and Maddin were repeated, and it is concluded that their high enhancements were due to the use of torsion in one direction. The homogeneity of cyclic torsion strain was found to be uniform. The results are compared with previous work, and an attempt is made to find the cause of the enhancements. NSA

N66-22114# Rensselaer Polytechnic Inst., Troy, N. Y.
PROJECT ON ANISOTROPIC DIFFUSION AND ELECTROMIGRATION Annual Report, 1 Dec. 1964–30 Nov. 1965
H. B. Huntington et al Jul. 1965 14 p refs
(Contract AT(30-1)-1044)
(RPI-1044-7)

In the electromigration studies, a small Soret effect was observed in Na but not in Zr. Other electromigration studies include Ag, transition metals, Co, Cu, and Na–K. Problems

of temperature measurement are considered. Preliminary results are reported for diffusion of Fe and Hg into Zn, and other anisotropic diffusion studies are also discussed. NSA

N66-22121# Cornell Univ., Ithaca, N. Y. Lab. of Atomic and Solid State Physics.
AN APPROXIMATE TECHNIQUE FOR CALCULATING LOCALIZED MODES
J. A. D. Matthew Jun. 1965 30 p refs
(Contract AT(30-1)-2391)
(NYO-2391-12) CFSTI: HC $2.00/MF $0.50

Asymptotic solutions for the frequency of the localized mode of an isotopic defect in a cubic lattice are examined, and interpreted in terms of the Einstein oscillator frequency of the impurity atom. The extension of such approximate solutions to situations in which the force constants change is examined and the method is applied to the case of the U center in the alkali halides. For all the alkali halide systems considered the assumption that the hydride ion behaves as an isotopic impurity gives poor agreement with experiment. It appears that the hydride ion is more softly coupled to its environment than the anion it replaces and the degree of softening increases as the size of the anion increases.
Author (NSA)

N66-22122# Nordisk Institut for Teoretisk Atomfysik, Copenhagen (Denmark).
THE APPLICATION OF UNITARY GROUPS IN PARTICLE PHYSICS WITH PARTICULAR EMPHASIS ON SU_6
N. Brene and B. Hellesen Mar. 1965 46 p refs
(NP-15286)

The foundations of the application of SU_6 group theory to elementary particles are outlined. NSA

N66-22129# Cornell Univ., Ithaca, N. Y. Dept. of Engineering Physics.
CORRELATION OF PHYSICAL PROPERTIES OF CRYSTALS WITH MICROSTRUCTURE Annual Technical Progress Report, 1 Jun. 1964–31 May 1965
J. Silcox [1965] 5 p refs
(Contract AT(30-1)-3087)
(NYO-3087-4) CFSTI: HC $1.00/MF $0.50

A brief summary is presented of the work carried out in the period June 1964 to May 1965. The topics studied included ferromagnetic properties of Ni and Ni alloys, coercivity of deformed Ni, magnetoresistance of Ni–Co alloys, and magnetic domains in permalloy. NSA

N66-22146# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Physik-Institut.
THE MOSSBAUER EFFECT OF THE 46.5 KEV LINE OF W-183 [MOSSBAUEREFFEKT DER 46.5 KEV-LINIE VON W-183]
Manfred Drosg and Endre Ujlaki 6 Nov. 1964 6 p refs In GERMAN Presented at the Autumn Session of the Austrian Phys. Soc., Graz, Austria, 1964 Submitted for Publication
(SGAE-PH-15/1964)

The Mossbauer effect of the 46.5-kev line of ^{183}W was measured with a Xe-filled proportional counter with a resolution of about 10%. W plates were used as absorber, and both absorber and source were cooled with liquid nitrogen and held at a temperature of 80°K. A resonance absorption fraction of 4.4% could be established. Because of the poor resolution of the NaI crystal, a corrected effect of about 26% was obtained. NSA

N66-22149# Iowa State Univ. of Science and Technology, Ames. Dept. of Physics.
MAGNETOSTRICTION OF DYSPROSIUM, ERBIUM, AND TERBIUM SINGLE CRYSTALS
James Jennings Rhyne (Ph.D. Thesis) Jul. 1965 179 p refs
(Contract W-7405-ENG-82)
(IS-T-21) CFSTI: HC $5.00/MF $1.00

The magnetostriction of Dy, Er, and Tb single crystals was measured from 300 to 10°K in applied magnetic fields up to 30 kOe. The temperature dependence of the magnetostriction constants appropriate to Tb and Dy was determined under the assumption that the magnetic moment is constrained to the basal plane by the magnetic anisotropy energy. The eleven magnetostriction constants appearing in the general fourth order theory are reduced to four constants in this case. The second and fourth order orthorhombic distortion constants were evaluated by strain measurements as a function of applied field direction in the basal plane. The remaining two constants describe isotropic dilatations of the basal plane and c axis. These were determined from isofield measurements of the a-, b-, and c-axis strain and subtraction of the thermal strain extrapolated from the paramagnetic region. In these measurements the saturating field was applied along the easy magnetic axis. The theoretical dependence of the anisotropic distortion constants on the magnetic moment was evaluated for Tb and Dy. The linear strains along the a, b, and c axes were obtained as a function of field applied along the easy axis. The anomalous results obtained in the helical antiferromagnetic temperature ranges are discussed. From these results the forced magnetostriction along the three axes was determined. Values of the six fold basal plane anisotropy constants of Dy and Tb were calculated from the magnetostriction data as a function of applied field angle. The measurement of magnetostriction of Er was complicated by the extremely high axial magnetic anisotropy which constrains the magnetic moment to the surface of a cone about the c axis. Only a semiquantitative determination of the anisotropic constant was possible. The field induced changes in the magnetic states of Er were studied, and a qualitative model explaining the effects was postulated. The temperature dependence of the strains in zero applied field and in a 30 kOe field applied in the basal plane and along the c axis was measured. Author (NSA)

N66-22161# Los Alamos Scientific Lab., N. Mex.
AN INTEGRATED SERIES OF CRYSTALLOGRAPHIC COMPUTER PROGRAM. V: GENERAL LEAST SQUARES REFINEMENT
Don T. Cromer, R. B. Roof, Jr., and Allen C. Larson 17 May 1965 111 p refs
(Contract W-7405-ENG-36)
(LA-3259) CFSTI: HC $4.00/MF $0.75

The procedures employed and the computer program used for determining the positions and thermal motions (isotropic and/or anisotropic) of the atoms in a single crystal are described. The basic technique involves an iterative least-squares procedure. A special feature of this program is the inclusion of a secondary-extinction correction as a least-squares parameter. Author (NSA)

N66-22242*# Hawaii Univ., Honolulu. Dept. of Physics.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF ELECTRON EMISSION, CONDUCTIVITY AND LUMINESCENCE OF SELECTED SOLIDS UNDER VACUUM UV RADIATION Status Report, No. 4, 1 May–31 Oct. 1964
William Pong and K. Watanabe [1964] 7 p
(Grant NsG-328)
(NASA-CR-80219) CFSTI: HC $1.00/MF $0.50 CSCL 20L

Absolute photoelectric yields of 20 alkali halides were measured in the spectral range of 12.4 to 21.2 eV. The photoelectric yield for most of these materials rises to values as high as 0.8 electron per incident photon in the fundamental band beyond the exciton region. At photon energies near twice the threshold, the yield often reaches a minimum of the order of 0.4 electron/incident photon. Beyond 2Eg the yield rises to large values. Many broad diffuse bands appear in the electron emission spectrum. Spectral photoemission yield and energy distribution measurements of emitted photoelectrons were made on evaporated layers of CuCl, CuBr, and CuI in a clean vacuum. A quantum yield rise was observed above 10 eV. The retarding potential data indicate the onset of a slow group of emitted photoelectrons at photon energies of about 10 eV. Results indicate the existence of inelastic scattering of photoexcited electrons by valence band electrons. The photoluminescent response of sodium salicylate was studied in a clean vacuum at from 80° to 500°K. Results indicate that the relative fluorescence efficiency decreases with temperature rise. R.N.A.

N66-22249*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DIELECTRIC CONSTANT OF THE LEAD SALTS
M. M. Sokoloski and P. H. Fang [1965] 6 p refs Submitted for Publication
(NASA-TM-X-56350) CFSTI: HC $1.00/MF $0.50 CSCL 20L

Microwave measurements of PbS were made to determine its dielectric constant. The experiment used the fact that a dielectric plate or window in a waveguide has a voltage standing wave ratio minimum whenever the plate thickness is n half-wavelengths, thus $\epsilon_e = (\lambda/n\ t)^2$ where ϵ_e is the dielectric constant, t the crystal thickness, λ the wavelength, and n the number of half-wavelengths transversing the sample in distance t. Three PbS natural crystal samples were lapped or lapped and etched to thicknesses of 3.77, 3.67, and 3.25×10^{-2} cm. average dielectric constant for the three samples was 161.5 ±0.6. Results are compared with those of other investigators. R.N.A.

N66-22359*# General Precision, Inc., Little Falls, N. J.
BEAM ALIGNMENT TECHNIQUES BASED ON THE CURRENT MULTIPLICATION EFFECT IN PHOTOCONDUCTORS First Phase Technical Summary Report
Raymond P. Borkowski, Aryeh H. Samuel, and Daniel Grafstein Washington, NASA, Apr. 1966 72 p refs
(Contract NAS12-8)
(NASA-CR-431) CFSTI: HC $1.05/MF $0.75 CSCL 20L

A series of experiments were conducted to study the multiplication effect in cadmium sulfide photoconductors, i.e., a rise in photocurrent when light beams are directed at exactly opposing spots on the opposite sides of a photoconductor with two transparent electrodes. Measurements were made on commercial polycrystalline CdS cells, with an evaporated metallic and a conducting glass electrode; the cells had very high extinction coefficients, approximately 10^3 cm^{-1}. The following relationships were established: For any incident wavelength on one side, the multiplication factor (M) is greatest when the other wavelength is about 5200 Å; the greatest value of M is obtained for the wavelength combination 5200 Å and 6500 Å. The value of M is found to decrease as the electric field across the photoconductor increases. The dependence of M on the area of the light spot was measured in constant flux and constant intensity; in both modes, a maximum M was found at an intermediate spot size, 0.5 to 1.0 mm, for most wavelength combinations. It was found that the value of M was not changed when the angle of incidence of light beams impinging on a given spot varied. D.T.

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N66-21385# Rocket Power, Inc., Pasadena, Calif. Research Labs.
THERMODYNAMIC PROPERTIES OF ROCKET EXHAUST PRODUCTS Quarterly Report, 1 Aug.–31 Oct. 1965
M. A. Greenbaum, R. E. Yates, M. A. Frisch, H. C. Ko., and M. Farber [1965] 25 p refs
(Contract AF 04(611)-10929)
(QR-1; AD-625598) CFSTI: HC $1.00/MF $0.50

Experiments are to be performed on thermodynamic and physical properties of some of the compounds of light metals likely to be formed by the combustion of solid or hybrid propellants and their additives at temperatures of 2000 to 5000° K. The thermodynamic properties are to be determined for gaseous BeOH, BOH, and $AlCl_2$, and the entropy of Be $(OH)_2$ is to be determined. Apparatus was assembled and constructed for these experiments. TAB

N66-21468# Stanford Research Inst., Menlo Park, Calif.
AN ANALYSIS OF THE SHOCK INITIATION OF GRANULAR EXPLOSIVES BY THE GAS COMPRESSION-CONDUCTION MECHANISM
C. M. Ablow, Y. D. S. Rajapakse, and Marjorie W. Evans 1 Oct. 1965 30 p refs
(Contract AF 49(638)-1124)
(WSCI-65-30; AFOSR-65-2308; AD-628033) CFSTI: HC $2.00/MF $0.50

The role of the gas compression-conduction mechanism in shock initiation of granular materials was studied by analyzing the dependence of grain surface temperature on the magnitude of the shock and the relative sizes of grain and surrounding volume of interstitial gas. It is shown that at one atmosphere initial ambient pressure the mechanism can be a contributing factor to initiation if particle size distribution or particle irregularity leads to the existence of small particles surrounded by large, gas-filled spaces; the required sizes are possible for real materials. At low pressures (approximately 10 microns Hg) on the other hand, it is unlikely that the mechanism is a contributing factor. Since in practice these granular masses can be shock-initiated independent of initial ambient pressure, the conclusion is that at least one primary initiation mechanism other than gas compression-conduction plays a role. TAB

N66-21515# Rocketdyne, Canoga Park, Calif.
COMBUSTION STABILITY RATING TECHNIQUES Quarterly Progress Report, Period Ending 30 Dec. 1965
L. P. Combs, J. A. Murphy, E. E. Lockwood, F. W. Hoehn, and M. Alexander Jan. 1966 79 p refs
(Contract AF 04(611)-10811)
(R-6355-2; AD-627343) CFSTI: HC $3.00/MF $0.75

Work conducted on a study of liquid-propellant rocket combustion stability rating techniques is reported. Experimental tests were made for cold-flow characterization of three rating methods: non-directional explosive bombs, directed blasts from explosive pulse guns, and directed flows of gases. Data relating the output characteristics of the method to particular design and input parameters are presented. Cold-flow characteristics are to be correlated with stability response of a rocket combustor when the techniques are applied during hot firings. Motor hardware and test stand preparations for the hot-firing program are described.
Author (TAB)

N66-22197*# Stanford Research Inst., Menlo Park, Calif.
PROPELLANT COMBUSTION PHENOMENON DURING RAPID DEPRESSURIZATION Quarterly Report No. 1, Jul. 1–Sep. 30, 1965
E. L. Capener, Lionel A. Dickinson and Gerald A. Marxman 12 Oct. 1965 36 p refs
(Contract NAS7-389)
(NASA-CR-71758) CFSTI: HC $2.00/MF $0.50 CSCL 21I

Studies were conducted to develop an understanding of the processes occurring during rapid depressurization of burning solid propellants. A theoretical model was proposed which appeared capable of explaining a large volume of combustion instability data. Burning rates of propellants with various oxidizers and binders were studied and data obtained are given. Lower deflagration and ignition threshold pressures for propellants of the same general composition were observed. The analytical studies are discussed and it is reported that a simple linear or exponential pressure-dependent type of burning law cannot adequately explain non-steady state phenomena.
H.S.W.

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N66-21130# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
A DESCRIPTION OF THE DOUGLAS AIRCRAFT COMPANY MODIFICATIONS AND ADDITIONS TO THE UAIDE S-C 4020 FORTRAN IV SOFTWARE
Walter P. Coston [1965] 16 p Presented at Users of Autom. Inform. Display Equipment 1965 Conv., New York, 14 Oct. 1965
(Rept.-3621)

In the use of the UAIDE FORTRAN IV S-C 4020 software, the following additions and modifications to the FORTRAN IV subroutines operating under IBSYS on the IBM 7094 were made: (1) the capability to write output on a tape other than on the standard output tape, (2) a procedure for opening the file, (3) a method of identifying and separating output from different jobs, (4) modifications to allow the subroutines to be used in overlay links, (5) a method of stacking the S-C 4020 output from several jobs onto one tape, and (6) a procedure for closing the S-C 4020 file.
Author

N66-21238# Joint Publications Research Service, Washington, D. C.
NEW TYPE OF INTERNAL COMBUSTION ENGINE
V. M. Kushul' 25 Mar. 1966 132 p refs Transl. into ENGLISH of chapters I, II, and IV of the book "Novyy Tip Dvigatelya Vnutrennego Sgoraniya" Leningrad, Sudostroyeniye, 1965 p 3–79, 164–208
(JPRS-34720; TT-66-31159) CFSTI: $4.00

Investigated is the design of a new type internal combustion engine that combines the favorable features of spark ignition and diesel engines; the favorable features being the high specific power and ability to control the combustion of the former and the high economy of the latter. The main features and operating principle of the new thermodynamic cycle engine are discussed, and results of tests conducted on an experimental engine using the new principle are summarized.
M.R.W.

N66-21299# Wissenchaftliche Gesellschaft für Luft- und Raumfahrt, Cologne (West Germany).
REPORT OF THE MEETING OF THE SCIENTIFIC COMMITTEE ON ROCKET TECHNIQUES [BERICHT UBER DIE SITZUNG DES FACHAUSSCHUSSES RAKETENTECHNIK]
Apr. 1965 99 p refs In GERMAN Meeting held in Cologne, 7 Feb. 1965
(DLR-65-03) CFSTI: HC $3.00/MF $0.75

Discussed were the following topics: (1) Thermodynamic Comparisons of Primary and Secondary Rocket Propulsion Units—pressurization techniques for short interval fuel injections and small amounts of fuel, and turbopump fuel dispersion for larger fuel amounts of longer duration; (2) Application Aspects of Primary and Secondary Rocket Propulsion Units—high pressure chambers with pre-ignition for combined oxygen-hydrogen rocket fuel propulsion units; and (3) Studies on Different Rocket Engine Turbine Fuel Pump Systems for Launch Vehicles with Maximal Payload Capabilities—propulsion system optimization for carrier rockets, and turbopump fuel injection with emphasis on maximal weight and efficiency ratio.
Tranl. by G.G.

N66-21367# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MANUFACTURE OF BASIC COMPONENTS AND ASSEMBLIES OF AIRCRAFT ENGINES
M. I. Yevstigneyev, I. A. Morozov, A. V. Podzey, A. M. Sulima, and I. S. Tsukanov 15 Oct. 1965 528 p refs Transl. into ENGLISH of the Book "Izgotovleniye Osnovykh Detaley i Uzlov Aviadvigateley" Moscow, Izd. Mashinostr., 1964 p 1–456
(FTD-MT-65-57; AD-624820) CFSTI: HC $8.25/MF $2.25

The book, which is a training aid for students of aviation higher educational institutions and departments, presents the technological processes of manufacture of the critical components and assemblies of aircraft engines. It considers their design features, technical specifications for manufacture and materials, construction of technological processes, methods of executing basic operations, and checking methods. The book will also be useful to engineers and technicians of the aviation industry.
Author (TAB)

N66-21429# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DYNAMIC PROCESSES IN A LIQUID PROPELLANT ROCKET ENGINE (CHAPTER III)

Ye. K. Moshkin 16 Sep. 1965 84 p Transl. into ENGLISH from the publ. "Dinamicheskiye Protesessy v Zhrd" Moscow, Izd. "Mashinostroyeniye", Moscow, 1964 p 170-251

(FTD-MT-65-104; AD-622607) CFSTI: HC $3.00/MF $0.75

Contents: Characteristic designs of engines and possible variants of the sequence of their operation; Character of relation between parameters of chamber and parameters of circuits; Investigation of relation between averaged parameters and dynamic processes by method of small finite deviations; Use of computer techniques in the investigation of rocket engines. TAB

N66-21436*# Jet Propulsion Lab., Calif. Inst. of Tech. Pasadena.

DEVELOPMENT OF THE RANGER BLOCK III SPACECRAFT PROPULSION SYSTEM

D. D. Evans, T. A. Groudle, and R. F. Mattson 15 Mar. 1966 52 p refs

(Contract NAS7-100)

(NASA-CR-71515; JPL-TR-32-829) CFSTI: HC $3.00/MF $0.50 CSCL 21H

This report describes the design, development, and flight operation of the midcourse propulsion system utilized on the Ranger Block III spacecraft. This monopropellant-hydrazine-fueled system delivers 50 lb_f of thrust and is capable of imparting a variable impulse to the spacecraft in order to accomplish required trajectory corrections resulting from launch-vehicle dispersion errors. These corrections are required so that the time-of-arrival and impact point can be optimized in order to obtain high-resolution television pictures of the lunar surface. The propellant feed system utilizes a conventional high-pressure gas-storage system, a unique pressure regulator, and a propellant tank containing a bladder for positive expulsion. Engine ignition is accomplished through the injection of a small quantity of a hypergolic oxidizer, nitrogen tetroxide. All valving functions are accomplished by explosively actuated valves. A detailed description of component and system testing is included, along with the in-flight performance of the system during the Ranger VI, VII, VIII, and IX missions. Author

N66-21695*# Bendix Corp., Southfield, Mich.

RESEARCH STUDY OF THE VORTEX VALVE FOR MEDIUM-TEMPERATURE SOLID PROPELLANTS

W. D. Holt and J. G. Rivard Washington, NASA, Apr. 1966 81 p refs

(Contract NAS1-4158)

(NASA-CR-424) CFSTI: HC $1.20/MF $0.75 CSCL 21I

The feasibility of throttling the flow of high temperature, contaminated gases with a vortex valve was studied on a 2000°F solid propellant gas generator, with a flow rate of 1 lb/sec. Six hot-gas secondary injection firings with this system, incorporating two vortex valves, supplied a flow of 1.0 lb/sec for 30 seconds. One of the vortex valves used active control, the other acted as pressure regulator maintaining the constant supply pressure by bypassing flow when the power valve was throttled. A flow modulation capability in excess of 4 to 1 was demonstrated. Cold gas testing of one-sixth scale model vortex valve resulted in changes of vortex valve geometry for optimal configuration and performance. Active control on both vortex valves and operation in a push-pull mode gave an amplitude attenuation of −4 db and a 28 degree phase lag at 30 cps. G.G.

N66-21887*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Florida Research and Development Center.

INVESTIGATION OF PRESSURE PREDICTION METHODS FOR LOW FLOW RADIAL IMPELLERS, PHASE III Final Report, Jun. 1963–Feb. 1966

W. E. Young and H. F. Hue 4 Feb. 1966 78 p refs

(Contract NAS8-5442)

(NASA-CR-71637; PWA-FR-1716) CFSTI: HC $3.00/MF $0.75 CSCL 21H

This report presents the results of work performed on the contract, "Pressure Prediction Methods for Low Flow Radial Impellers." The objectives of this program were to (1) determine, experimentally, the effect of changes in geometry and operating conditions on the radial pressure distribution along the low flow back face of centrifugal pump impellers, and (2) using the experimental results, formulate a computer program that can be used to predict pressure distribution within the range of variables tested. The work was conducted in three phases; the first phase was devoted exclusively to investigating incompressible flow performance with smooth and bladed disks in smooth housings using water as the test fluid. In the second phase the incompressible flow study was expanded to include rotor end effects and all previous tests were repeated to determine flow performance using liquid hydrogen as the test fluid. The third phase was intended to fill in and complete the data from the first two phases, and to investigate one additional configuration, that of a smooth disk with bladed housings. Author

N66-21893# Polytechnic Inst. of Brooklyn, Farmingdale, N. Y.

HIGH-FREQUENCY COMBUSTION INSTABILITY AND SCALING OF LIQUID PROPELLANT ROCKET MOTORS

Vito D. Agosta, Sanford S. Hammer, and William T. Peschke [1965] 15 p

(Contract AF 49(638)-1263)

(AFOSR-65-2501; AD-628014) CFSTI: HC $1.00/MF $0.50

The following theoretical and experimental programs are in progress which are related to the instability and scaling problems in rocket motors: A steady-state aero–thermochemical analysis for a liquid bipropellant rocket motor with small contraction ratio employing droplet ballistics for both fuel and oxidizer. A non-linear wave propagation analysis in a droplet burning heterogeneous combustion field. A non-steady droplet evaporation analysis and concomitant experimental verification. The paper includes the experimental results obtained thus far from investigating the oscillatory behavior of the 500 lbm thrust JP6-Lox rocket motor. Author (TAB

N66-22244*# General Dynamics/Astronautics, San Diego, Calif. Space Science Lab.

THE USE OF A COAXIAL GUN FOR PLASMA PROPULSION Final Report

R. H. Lovberg, B. Hayworth, and T. Gooding 15 May 1965 93 p refs

(Contract NAS5-1139)

(NASA-CR-64213; AE62-0678) CFSTI: HC $3.00/MF $0.75 CSCL 21C

An investigation was undertaken to determine whether the coaxial gun concept is feasible for plasma propulsion. The study dealt with two broad areas: the physics of the acceleration process in a coaxial gun, especially those phenomena which influence efficiency; and the engineering feasibility of the free gas flow high repetition rate mode of operation

Priority was given to physical measurements of plasma phenomena in the gun. The experiments conducted were done on a series of coaxial guns which successively incorporate parameter changes dictated by the experimental results. These are designated Mark I through Mark IV. Their characteristic parameters and experimental behavior are discussed and a description of their mechanical details is included in the appendix. The principal diagnostic tools used were magnetic and electric probes. The program demonstrated that plasma acceleration by $\vec{j} \times \vec{B}$ forces does not take place in snowplow fashion, but rather through momentum transfer from an ionizing current wave which moves through the plasma. R.N.A.

N66-22268*# Aerojet-General Corp., Sacramento, Calif. Liquid Rockets Operation.
AERODYNAMIC DESIGN—MODEL II TURBINE M-1 FUEL TURBOPUMP ASSEMBLY
T. W. Reynolds 15 Apr. 1966 74 p refs
(Contract NAS3-2555)
(NASA-CR-54820; AGC-8800-52) CFSTI: HC $3.00/MF $0.75 CSCL 21H

A two-row staged turbine was designed as a direct drive for the M-1 liquid hydrogen turbopump. The design-point calculated shaft output is 88,150 horsepower at 13,225 rpm. The estimated turbine efficiency is 62.8% at a velocity ratio of 0.188. The mean blade diameter is 23.0-in., giving a tip speed of 1490 ft/sec. Author

N66-22292 British Aircraft Corp., Filton (England). Propulsion Group.
A FULLY INTEGRATED PROPULSION SYSTEM FOR A SUPERSONIC TRANSPORT AIRCRAFT
J. E. Talbot and B. Furness *In* AGARD Aerodyn. of Power Plant Installation, Pt. 2 Oct. 1965 p 513–538 refs (See N66-22286 11-01) CFSTI: HC $7.00/MF $2.00

The separate development of intake and nozzle for a supersonic powerplant may lead to components which are, individually, very efficient. However, when integrated into a unit some of this efficiency may be lost in producing compatibility with the engine and the remainder of the powerplant. In addition it is often found that the most efficient components lack flexibility in the face of changing atmospheric conditions. This paper illustrates the problem and indicates that flexibility can be achieved by suitable development and choice of components, the aim being to select a compatible combination which would reduce the demands on the intake control system without incurring a severe penalty in performance. For the purposes of illustration the problem is treated in terms of quasi-static effects of changes in ambient temperature on performance. Author

N66-22294 Rolls-Royce, Ltd., Derby (England).
JET LIFT INTAKES
W. F. Wiles *In* AGARD Aerodyn. of Power Plant Installation, Pt. 2 Oct. 1965 p 559–586 (See N66-22286 11-01) CFSTI: HC $7.00/MF $2.00

The air intakes for lift and lift cruise engines present particular problems because they have to work over a wide range of conditions. The paper gives a summary of these and a brief history of the problems which have arisen. From the early days of work on the Short SC. 1., it became apparent that considerable effort was required on lift intakes and an extensive model research programme has been done at Rolls-Royce. Initial work covered a very wide range of intakes to find the most suitable type. Scoop type intakes were selected early on and have been used on several aircraft. Simpler intakes were then developed, for example those with a cascade of vanes in front of the first engine. Work is still going on in this field on various engine configurations, the main objective being to reduce the installed volume of the engine, in particular that required for the intake. Author

N66-22295 Fiat S.p.A., Turin (Italy). Aviation Div.
TECHNIQUES FOR THE SIMULATION OF JET-LIFT ENGINES IN WIND-TUNNEL MODELS OF V/STOL AIRCRAFT
Ugo Sacerdote *In* AGARD Aerodyn. of Power Plant Installation, Pt. 2 Oct. 1965 p 587–617 refs (See N66-22286 11-01) CFSTI: HC $7.00/MF $2.00

A number of techniques have been developed in different countries for the simulation of jet-lift engines in wind-tunnel models of V/STOL aircraft. Some of these techniques reproduce separately the air intake flow and the jet; in this way it is only possible to investigate either the local air intake effects or the interference between the high velocity jets, the external flow and the adjacent aircraft parts. The simultaneous simulation of the air intakes and of the jets is required for the measurement, in the wind tunnel, of the aerodynamic force and moment coefficients of V/STOL aircraft models, and particularly to investigate the transition phase. To this end a special technique has been developed, at FIAT Aviation Division, based on the application of compressed air ejectors. The compressed air is ducted to the model through a system of tubes floating on compressed air bearings, to minimize the forces and/or moments induced on the model. The basic assumptions on which this particular technique is based, the calibration tests performed, and the data-reduction methods are illustrated, together with a summary of wind-tunnel results. Author

N66-22298 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NASA RESEARCH ON THE AERODYNAMICS OF JET VTOL ENGINE INSTALLATIONS
Richard E. Kuhn and Marion O. Mc Kinney, Jr. *In* AGARD Aerodyn. of Power Plant Installation, Pt. 2 Oct. 1965 p 689–713 refs (See N66-22286 11-01) CFSTI: HC $7.00/MF $2.00

This paper summarizes some of the more pertinent results of NASA investigations related to the aerodynamics of jet VTOL engine installations. It shows that there is a base loss in hovering due to suction forces created on the underside of the fuselage by the entrainment of ambient air in the slipstream, and that the magnitude of this effect is related to the turbulence in the jet stream and its consequent rate of mixing with ambient air. It also shows that there are large lift losses and pitching moments due to jet-free-stream interference and that these characteristics can be significantly altered by proximity to the ground. And, finally, it shows that simple bell-mouth inlets give good pressure recovery and low distortion for vertically mounted lift engines if the inlet lip radius is sufficiently large, but that such inlets are not suitable for windmill starting of the engines. Author

N66-22307 Rolls-Royce, Ltd., Derby (England).
THE ENGINE DESIGNER'S POINT OF VIEW
L. G. Dawson *In* AGARD Aerodyn. of Power Plant Installation, Pt. 1 Oct. 1965 p 1–22 (See N66-22306 11-01) CFSTI: HC $7.00/MF $2.00

The distorted flow entering engine compressors is discussed with respect to power plant design specifications for delivering air to the compressor face. Compressors were found to be greatly affected by circumferential distortion but hardly at all by radial distortion of the inlet total pressure. It was found possible to predict the loss in surge pressure ratio from the effective pressure distortion ratio. Next a relation between surge pressure ratio and inlet flow distortion permits the expression of the latter as an equivalent loss in performance. This suggests a value of distortion for optimum matching, and typical cases are presented. The situation for military aircraft as well as civil aircraft is considered. The problem of hot gas entering the engine is discussed, along with its effect on the surge line. N.E.N.

N66-22309 Bristol Siddeley Engines, Ltd. (England).
THE FEASIBILITY OF SUPERSONIC COMBUSTION RAMJETS FOR LOW HYPERSONIC SPEEDS
R. Hawkins *In* AGARD Aerodyn. of Power Plant Installation, Pt. 1 Oct. 1965 p 69–115 refs (See N66-22306 11-01) CFSTI: HC $7.00/MF $2.00

The performance of a supersonic combustion ramjet is examined in relation to that of a conventional subsonic ramjet. At low hypersonic speeds the internal performance of the two cycles are comparable, but at speeds above Mach 7, the supersonic combustion cycle should offer superior performance. Beyond Mach 9 the lack of reliable intake data makes the estimation of possible engine performance highly conjectural. As an acceleration engine the supersonic combustion ramjet, flying at relatively low altitudes, offers possibilities unattainable with a conventional ramjet. Typical entry conditions for a supersonic combustor are deduced. A detailed appraisal of available data on mixing and reaction rates is made in order to assess the feasibility of supersonic combustion, particularly at low hypersonic flight speeds. Author

N66-22312 British Aircraft Corp., Preston (England).
AIRCRAFT PERFORMANCE PROBLEMS ASSOCIATED WITH ENGINE AND INTAKE INSTALLATION
John Weir *In* AGARD Aerodyn. of Power Plant Installation, Pt. 1 Oct. 1965 p 173–194 refs (See N66-22306 11-01) CFSTI: HC $7.00/MF $2.00

The compromise between subsonic and supersonic requirements of the intake and afterbody nozzle design is discussed for aircraft which spend most of their time at subsonic cruise conditions but which still retain the ability to accelerate rapidly to M=2.0 and beyond. The usual approach of designing the intake and nozzle for supersonic speeds and then minimizing the penalties that result at subsonic speeds is questioned. The approach which first fulfills subsonic requirements, accepting some supersonic penalties, is considered in more detail. Sufficient data exist to illustrate the attractions of this approach but much more testing is required, particularly on jet interference on afterbody drag at supersonic speeds and on intake boundary layer bleed drag at subsonic speeds. Author

N66-22314 Naval Air Test Center, Patuxent River, Md.
METHOD OF NET THRUST MEASUREMENT IN SUPERSONIC FLIGHT
Theron W. Davidson *In* AGARD Aerodyn. of Power Plant Installation, Pt. 1 Oct. 1965 p 217–244 refs (See N66-22306 11-01) CFSTI: HC $7.00/MF $2.00

The feasibility and accuracy of the traversing rake system, which samples pressures and temperatures through the engine exhaust has been established. Initial results show data to be within 2–3% gross thrust and 4–5% net thrust. This accuracy is expected to be maintained with the new automatic data acquisition and processing system. This system, which utilizes airborne magnetic tape, analyzes and plots thrust and drag data in a matter of minutes. The rake promises developmental and research application bypassing extensive engine test cell calibrations. Author

N66-22315 Nord-Aviation, Paris (France).
PAST FLIGHT EXPERIENCE AND RECENT DEVELOPMENTS IN COMBINATIONS OF RAMJET AND TURBOJET ENGINES
A. Gozlan *In* AGARD Aerodyn. of Power Plant Installation, Pt. 1 Oct. 1965 p 245–270 (See N66-22306 11-01) CFSTI: HC $7.00/MF $2.00

In the paper a general approach to the problem of compound power plants is set forth, the experience gained with the Griffon flight testing is summarized and the results of the latest research work are presented. Furthermore, it is shown how additional sophistication, involving the use of cryogenics, might extend the efficient operating range into the hypersonic regime, while taking advantage of the most recent advances in this field. Author

N66-22316 North American Aviation, Inc., Los Angeles, Calif.
ADDITIVE DRAG ON INLET COWLS AND ITS EFFECT ON AIRCRAFT PERFORMANCE
Joseph S. Mount *In* AGARD Aerodyn. of Power Plant Installation, Pt. 1 Oct. 1965 p 271–300 refs (See N66-22306 11-01) CFSTI: HC $7.00/MF $2.00

If the operational requirements for a turbojet-powered aircraft require the inlet to operate off-design at reduced inlet mass flows, the theoretical additive drag can be significant in magnitude, compared to the basic aircraft drag. This could be equivalent to large penalties in range. Proper cowl design will allow much of this potential drag increment to be cancelled by a cowl suction force. For subsonic inlets at subsonic Mach numbers, test results show that about 80% of the theoretical additive drag can be recovered with a reasonably short and thin cowl. For the same subsonic inlets at low supersonic Mach numbers, about 50%–60% can be recovered. For supersonic inlets at subsonic Mach numbers, the amount of theoretical additive drag cancellation that can be achieved is probably less, varying from 0 to 60% for a limited number of configurations recently tested. However, the configurations showing the best cancellation had higher basic drag levels. Author

N66-22334* National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
CONTINUOUS CARBON ABSORPTION STUDIES
C. C. Ferriso, C. B. Ludwig (Gen. Dyn./Convair), and Robert M. Huffaker *In its* Aero-Astrodyn. Res. Rev. No. 3 15 Oct. 1965 p 34–38 (See N66-22329 11-34) CFSTI: HC $4.00/MF $1.00

For thick optical paths of interest for Saturn type 1st stage boosters, carbon contributes more than 50 percent of the total emission. The absorption coefficient of this carbon produced in a RP-1/oxygen rocket engine combustion chamber has been experimentally determined and an analytical model developed which accurately expresses the absorption coefficient as a function of temperature, density, and

wavelength. These measurements were made on a small rocket motor with the perfect nozzle designed by the method of Foelsch. This nozzle produces homogeneous, shockfree, axially parallel exit gases. Author

N66-22352*# Lockheed-California Co., Burbank.
A TRANSIENT HEAT TRANSFER AND THERMODYNAMIC ANALYSIS OF THE APOLLO SERVICE MODULE PROPULSION SYSTEM. VOL. I, PHASE I: TRANSIENT THERMAL ANALYSIS Final Report, 28 Jul. 1964–28 Jul. 1965
B. A. Nevelli, H. R. Holmes, M. A. Kazarian, H. D. Schultz, and I. Shuldiner 10 Aug. 1965 446 p refs
(Contract NAS9-3349)
(NASA-CR-65331; LR-18899, Vol. I) CFSTI: HC $7.46/MF $2.25 CSCL 21H

The three-dimensional transient heat transfer and thermodynamic behavior of the Apollo service module propulsion system were determined for three entire missions: earth suborbital, earth orbital, and lunar orbital rendezvous. The analysis provided temperature–time histories of all service module components important to the service propulsion system (SPS). The service module was represented by three separate thermal networks for all components, with the exception of the cryogenic tankage and the reaction control system. It was found that the temperatures of several SPS components would exceed their prescribed temperature limits during the earth orbital and lunar orbital rendezvous mission. These components are in the region of the fuel cells, the thrust chamber, and the disconnect panels. The fuel cells are partially or totally responsible for the thermal problems discovered, with the exception of the disconnect panels. Only area of unacceptably low temperatures is in the propellant disconnect couplings adjacent to the disconnect panels. No SPS thermal problems were discovered for the earth suborbital mission, the result of short mission duration and the absence of fuel cell operation. E.A.O.

N66-22353*# Lockheed-California Co., Burbank.
A TRANSIENT HEAT TRANSFER AND THERMODYNAMIC ANALYSIS OF THE APOLLO SERVICE MODULE PROPULSION SYSTEM. VOL. II, PHASE II: THERMAL TEST PROGRAM Final Report, 28 Jul. 1964–28 Jul. 1965
P. S. Starrett, K. J. Kahn, M. A. Kazarian, and H. H. Ogimachi 10 Aug. 1965 347 p refs
(Contract NAS9-3349)
(NASA-CR-65332; LR-18899, Vol. II) CFSTI: HC $7.00/MF $1.75 CSCL 21H

A series of models related to the Apollo service module was tested to investigate internal and external heat transfer under a variety of dynamic thermal environments. The test program utilized five series of test models of increasing complexity that led to a 1/3 scale geometric representation of the Apollo service module. For each of the models tested, an equivalent lumped resistance-capacitance thermal analysis network was generated. Analytical predictions of transient temperatures on the models were compared with the experimental results to determine the degree of correlation. Since neglect of interreflections resulted in low predictions of internal radiant heat transfer, an approximate method was developed to account for the reflections by modifying the effective emissivity. Predicted temperatures were generally lower than experimental due to the underprediction of heat transfer from the simulated thrust chamber. In the fluid storage and pressurization program, the thermal analysis gave reasonably good predictions of the thermal response of the system. Facility description, selected test data, and test methods are appended. E.A.O.

N66-23369*# Martin Co., Denver, Colo.
PRESSURIZATION SYSTEM FOR USE IN THE APOLLO SERVICE PROPULSION SYSTEM, PHASE I Interim Report
D. N. Gorman and G. R. Page Jul. 1965 103 p
(Contract NAS9-3521)
(NASA-CR-65314; CR-65-50) CFSTI: HC $4.00/MF $0.75 CSCL 21H

Surveys were conducted to develop a lightweight pressurization system for use in the Apollo Service Propulsion System. The survey produced nine basic pressurization systems for consideration and each of the systems is summarized and illustrated schematically. Detailed design analyses, and analytical and experimental considerations resulted in the selection of a cascade helium storage–propellant line heating system. This system is discussed and the reasons for its selection are analyzed. H.S.W.

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N66-21272# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
DETERMINATION OF SOLAR PROTON ENERGY SPECTRUMS BELOW 100 MEV FROM GROUND-BASED MEASUREMENTS
G. W. Adams and A. J. Masley Feb. 1966 24 p refs
(SM-51974)

A technique is presented for calculating solar proton energy spectrums from electron density profiles measured during solar cosmic ray events. The electron density profile is converted to an electron-ion pair production rate profile, and the spectrum determined by using the proton range-energy relations. This technique is applied to seven electron density profiles determined with multifrequency riometers in the July 1961 solar cosmic ray events, and the resulting spectrums are compared to satellite measurements. Coupling this method of calculation with the multifrequency riometer technique for determining electron density profiles gives a means of determining solar proton energy spectrums entirely from ground-based measurements. Author

N66-21273# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
COMMENTS ON SOLAR ALPHA-PARTICLE CONTRIBUTIONS TO RIOMETER MEASUREMENTS
G. W. Adams and A. J. Masley Feb. 1966 28 p refs
(SM-51997)

Arguments are advanced to show that the α-particle contribution to riometer measurements of energy absorption in the ionosphere is an inverse function of an arbitrarily chosen

cutoff point in the energy spectrum. If the cutoff point is low, i.e., 50 MeV, then the most effective protons will be eliminated, but not the most effective α-particles. Thus, the α-particle contribution will be seen to dominate the proton contribution as the cutoff point is lowered. D.T.

N66-21574 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PROBLEM OF A CONDUCTING SPHERE IN A STATIONARY PLASMA

V. S. Anastasevich *In its* Cosmic Res., Vol. 3, No. 5 20 Jan. 1966 p 66-80 refs (See N66-21566 11-30) CFSTI: HC $6.00/MF $1.25

The concept of Debye screening is applicable to a charged object in the case of statistical equilibrium. In the case of systems not in statistical equilibrium, an electrical field may penetrate a plasma to great depths. Such systems include objects in outer space, irradiated by primary cosmic rays. Since primary cosmic rays include only positive ions, electrical fields must be generated in the plasma surrounding the cosmic bodies. An attempt is made to compute the magnitudes of the electrical field strengths in the equatorial planes of the Earth and sun. These computations are based on the assumption that an inhomogeneous magnetic field of cosmic objects is an effective trap for the charged plasma particles and that the compensation of the excess charge is accomplished by a flow of electrons produced by their displacement on collision with the ions. An estimate is also given of the difference in potentials between the space object and the plasma at infinity. This difference can be easily computed if the total electrical resistance of the plasma occupying the space between the cosmic object and infinity is known. Author

N66-21577 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE X-RADIATION OF A QUIET SUN

S. L. Mandel'shtam, V. S. Prokudina, I. P. Tindo, and Ye. P. Fetisov *In its* Cosmic Res., Vol. 3, No. 5 20 Jan. 1966 p 113-134 refs (See N66-21566 11-30) CFSTI: HC $6.00/MF $1.25

Results are presented for the calculation of the thermal X-ray emission of the sun in the region of wavelengths shorter than 20 Å units. Theoretical magnitudes of the radiant fluxes are compared with the experimental data. As a "volumetric measure of the emission" of various regions of the corona, included as part of the calculation data, the experimental values provided by a radiospectroheliogram on the 9.1-cm wave are taken. The temperature of the unperturbed corona is assumed to be $\sim 1 \times 10^{6}$° K, and the regions with an elevated emission reading are assigned temperature values ranging from 1.5 to 2.5×10^{6}° K. The theoretical and experimental values of the flow of X-ray emission are in good agreement for the various levels of solar activity. This permits the conclusion that the X-ray emission of the sun in a region shorter than 20 Å is thermal in nature; this radiation is composed of a virtually constant component originating in unperturbed regions of the corona, and to this component is added a slowly changing component corresponding to "hotter" radiation from the active regions of the corona. Author

N66-21578 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE SOLAR FLARES OF 28 SEPTEMBER 1961 AND 20 MARCH 1958

A. A. Korchak *In its* Cosmic Res., Vol. 3, No. 5 20 Jan. 1966 p 135-151 refs (See N66-21566 11-30) CFSTI: HC $6.00/MF $1.25

The burst of X-rays during the flares on 28 September 1961 and 20 March 1958 is satisfactorily explained by bremsstrahlung of the nonrelativistic electrons accelerated during the time of the flare. The simultaneous generation of a radio burst can be explained by synchronous emission, if the energy spectrum for the electrons in the region of the relativistic energies is extended. The consequences of this hypothesis are considered. Author

N66-21579 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MEASUREMENT OF COSMIC RADIO EMISSION AT FREQUENCIES OF 210 AND 2200 kc AT DISTANCES UP TO 8 EARTH RADII ON THE ZOND 2 AUTOMATIC INTERPLANETARY STATION

V. I. Slysh *In its* Cosmic Res., Vol. 3, No. 5 20 Jan. 1966 p 152-166 refs (See N66-21566 11-30) CFSTI: HC $6.00/MF $1.25

The intensities of the distributed cosmic radio emission at frequencies of 210 and 2200 kc, as measured from the Zond 2 automatic interplanetary station at distances up to eight earth radii, are respectively equal to 2.7×10^{-19} and 1×10^{-20} watt/m^2 × cycle × steradian. The electron concentration profile in the vicinity of the earth (out to $R = 7R_Z$) may be described by the function $1.3 \times 10^{5}(R_Z/R)^4$ electrons/cm^3. Influence of the plasma and magnetic field on the parameters of the receiving antenna was detected. Author

N66-21628 Chicago Univ., Ill.

COSMIC RAY NEUTRON INTENSITY MONITOR

John A. Simpson and John A. Lockwood (N. H. Univ.) *In* AFCRL Geophys. and Space Data Bull, Vol. II, No. 1 [1965] p 15–37 refs Prepared jointly with N. H. Univ. (see N66-21626 11-13) CFSTI: HC $6.00/MF $1.50

Tabulated cosmic ray neutron intensity data are presented which were obtained from neutron monitors at Chicago, Illinois; Climax, Colorado; and Huancayo, Peru. These data are prepared with both neutron monitor station sections (A and B) combined into a single count rate with the sum, number of hours operating, and mean for the day also indicated. R.N.A.

N66-21632 Sacramento Peak Observatory, Sunspot, N. Mex.

SOLAR OPTICAL PATROL OBSERVATIONS

Howard L. de Mastus *In* AFCRL Geophys. and Space Data Bull., Vol. II, No. 1 [1965] p 177–230 (See N66-21626 11-13) CFSTI: HC $6.00/MF $1.50

The Sacramento Peak Observatory at Sunspot, New Mexico performs daily observations of the sun in H-alpha light to record transient chromospheric phenomena such as flares and plages and in white light to record sunspots and faculae. These photographic patrols are supplemented by visual inspections of the sun and other patrols of the corona, prominences, and chromosphere. Data on chromospheric flares, flare film record, chromospheric activity other than flares, white light visual sunspot drawing, spectrographic coronal observations, and sunspot group analysis are tabulated. The coding system used in the presentation of these data is also described. R.N.A.

N66-21633 Harvard Coll. Observatory, Fort Davis, Tex.
SOLAR RADIO EMISSION. PART A: SPECTRAL OBSERVATIONS. PART B: RADIO NOISE MEASUREMENTS
Alan Maxwell and Michael Anastassiades (Natl. Obs. of Athens) *In* AFCRL Geophys. and Space Data Bull., Vol. II, No. 1 [1965] p 231-242 Prepared jointly with Natl. Obs. of Athens (See N66-21626 11-13) CFSTI: HC $6.00/MF $1.50

Data are presented on solar radio emission in the spectral range 50 to 320 Mc recorded at the Radio Astronomy Station of Harvard College Observatory, Fort Davis, Texas. The following activity is listed: limited information on noise storms (type I), slow drift bursts (type II), groups of fast drift bursts with more than 10 individual bursts (type IIIG), and continuum bursts (type IV). Idealized examples of the bursts are shown. R.N.A.

N66-21654*# Illinois Univ., Urbana. Engineering Experiment Station.
IONOSPHERIC ELECTRON CONTENT AT TEMPERATE LATITUDES DURING THE DECLINING PHASE OF THE SUNSPOT CYCLE
K. C. Yeh and B. J. Flaherty Feb. 1966 45 p refs
(Grants NsG-24-59; NSF GP-411)
(NASA-CR-71393) CFSTI: HC $2.00/MF $0.50 CSCL 04A

The values of electron content obtained by observations of Faraday effect for the period July 1961 to October 1964 are presented. These values, when combined with values obtained by other workers at a time when the sun was more active, enable us to study the diurnal, seasonal, and sunspot dependence of the electron content and the slab thickness. These experimentally measured quantities are then related to the physical quantities such as the diffusion coefficient, and the electron and ion temperatures by using a diffusion transport model. The seasonal dependence of the electron content and the slab thickness are not in agreement. Possible causes of seasonal anomaly are examined in terms of a diffusion transport layer. The most favored mechanism seems to be the change of composition of the minor constituent O_2 or N_2. The slab thickness is found to increase with increasing magnetic activities. Author

N66-21778*# California Univ., La Jolla. Dept. of Physics.
RADIO ELECTRONS AND MAGNETIC FIELDS IN THE GALACTIC HALO
James E. Felten 8 Feb. 1966 16 p refs Submitted for Publication Prepared in part at Cornell Univ.
(Grant NsG-357; Contract AF 49(638)-1527)
(NASA-CR-71547) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The density of radiating electrons in the galactic halo is reexamined in the light of recent cosmic ray data. A flux $\phi_h(E) \approx 0.8 \times 10^{-2} E^{-2.4}$ (cm^2 sec sr GeV)$^{-1}$ in 0.6-3.5 GeV is proposed; this is one to two percent of the quiescent primary proton flux and is higher than estimates used previously in deriving the halo magnetic field from radio brightness measurements and models of the halo. The halo field implied by such a flux is $\approx (2-3.5) \times 10^{-6}$ gauss; the lower figure corresponds to the uniform radio emissivity originally given for the halo by Baldwin, the higher to Mills's value for the central regions. Higher field estimates obtained analogously by other authors are discussed. Author

N66-22178*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POSSIBLE NEUTRALITY OF COSMIC RADIATION
K. A. Brunstein and T. L. Cline Nov. 1965 12 p refs Submitted for Publication
(NASA-TM-X-55402; X-611-65-479) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The possible equality of the numbers of electrons and of charged nucleons in low energy cosmic radiation is considered, along with its implications. Recent experiments have indicated the presence of electrons in the upper atmosphere and in interplanetary space. The supernovae and galactic-center catastrophic origin and the metagalactic origin of cosmic ray particles are discussed, based on the assumption that the proton and electron spectra are essentially the same outside the solar system. N.E.N.

N66-22196*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
QUASI BIENNIAL VARIATION OF COSMIC RAYS [LA VARIATION QUASI BIENNALE DES RAYONS COSMIQUES]
Kaichi Maeda and Tomoshigo Suda (Meteorol. Res. Inst.) [1965] 26 p refs In FRENCH Submitted for Publication
(NASA-TM-X-56690) CFSTI: HC $2.00/MF $0.50 CSCL 20H

Based on meteorological investigations, the quasi biennial variation of cosmic radiation in tropical regions was theoretically estimated. The amplitude of variation was predicted to be approximately 0.03% for ordinary radiation intensity, and 0.2% for radiation intensity underground. It is shown, based on data free of geomagnetic disturbances, that the greatest peak of the amplitude spectrum for Huancayo at 12° S occurs at intervals from 16 to 60 months; for Cheltenham at 39° N the amplitude spectrum peak occurs at intervals from 24 to 40 months. Transl. by D.T.

N66-22210*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CORRELATED MAGNETIC TAIL AND RADIATION BELT OBSERVATIONS
Norman F. Ness and Donald J. Williams Jul. 1965 14 p refs Submitted for Publication
(NASA-TM-X-56665; X-612-65-285) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Simultaneous observations from both the IMP-I and APL satellite 1963 38C during a magnetic disturbance in April 1964 showing the interplay between the earth's magnetic tail and the radiation belts within the magnetosphere are reported. During this period the satellites were sampling the trapped electron population at an altitude of 1100 Km. Graphic data showing curves of terrestrial magnetic disturbance of interest are depicted and used for interpreting the April 1964 observations. L.S.

N66-22224*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CHARGE RATIO OF COSMIC-RAY ELECTRONS
Frank C. Jones [1965] 9 p refs Submitted for Publication
(NASA-TM-X-56668) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Equations for the decay of isobars are worked out for illustrating that the assumption that a given observed electron constitutes a random sample of the secondaries from a particular high energy collision is not true; and that at high energies the charge ratio $N(e^+)/N(e^-)$ is considerably larger than one. Most authors have made the assumption that at high energies the ratio is approximately one. L.S.

N66-22227*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.

COSMIC RAYS AND THEIR FORMATION OF A GALACTIC HALO

E. N. Parker Feb. 1965 41 p refs Submitted for Publication (Grant NsG-96-60)

(NASA-CR-57491; EFINS-65-9) CFSTI: HC $2.00/MF $0.50 CSCL 20H

It is demonstrated that a magnetic gas cloud confined by gravity has no equilibrium configuration if cosmic rays are generated within it. Applying the theorem to the galaxy, it is shown that cosmic rays lead to inflation of the galactic magnetic fields, producing a halo of cosmic rays and field around the galaxy. Present observational estimates of cosmic ray life, magnetic field strength, etc. indicate an outward inflation rate of the order of 10^2 km/sec, though this number may be revised with improved observations. This cosmic ray halo extends far out from the disk and nucleus of the galaxy, presumably limited only by instabilities which must eventually free the cosmic rays and fields at a great distance. The field inflation acts as a pressure regulator on the cosmic rays generated in the galactic disk and nucleus, so that the life of a cosmic ray particle in the disk of the galaxy is determined mainly by the rate of generation of cosmic rays. Present estimates of the cosmic ray life are based on the rather uncertain value of the interstellar gas density. The gas is intimately associated with the dynamics of the galactic fields and with the rate of cosmic ray production. Author

N66-22228*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ELECTRON ACCELERATION IN THE TRANSITION REGION BEHIND THE EARTH'S BOW SHOCK

David L. Webster [1964] 22 p refs Submitted for Publication (NASA-TM-X-56197) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The highly disordered field found by Pioneer I in the transition suggests a possible explanation for the 'spikes' of high-energy electrons found by later satellites. Such a field must develop a great variety of local space-time patterns. If an effective field pattern develops in the transition region, some of the electrons already in the high-energy tail of the velocity distribution may be accelerated to very much higher energies, and then they may escape from the pattern before reversed induction can take energy away from them. After escape, they may make further gains of energy by Fermi accelerations and related mechanisms. Thus they should spread over a wide part of the transition region, some of them even going out through the bow shock or into the magnetosphere; and if a spike found by any satellite is ascribed to such electrons, the field pattern in which they started to gain high energy was not necessarily very near that satellite. Author

N66-22258*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE CONTINUAL ACCELERATION OF SOLAR PROTONS IN THE MeV REGION

D. A. Bryant, T. L. Cline, V. D. Desai, and F. B. Mc Donald [1965] 11 p refs Submitted for Publication

(NASA-TM-X-56274) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Evidence is presented for the long term persistence of a new solar emitted component consisting of protons in the 3 to 20 MeV region. These low energy protons are contained in streams of approximately 30 to 120 degree width of the Earth's orbit and are present over many solar rotations. These recurrence events are characterized by both a very low intensity level and a very steep energy spectrum. In contrast to the solar proton event, no velocity dispersion is observed among the various energy groups. When a stream is encountered, it is observed that both 3 and 10 MeV particles are present simultaneously, indicating that a quasi-equilibrium state has been established. Results from Explorer measurements of these particles are discussed. The continued presence of these particles is taken as evidence that they are being continually accelerated by the sun. Whether this acceleration occurs near the solar surface or in interplanetary space at the turbulent interface between the faster moving plasma of the stream and the slower moving plasma at the quieter surrounding region cannot be determined as yet. The latter interpretation is preferred as data tends to support this view. R.N.A.

N66-22351*# LTV Aerospace Corp., Dallas, Tex. LTV Astronautics Div.

ANALYSIS OF POLAR CAP ABSORPTION EVENTS. I: EFFECT OF SOLAR AND SOLAR INDUCED CONDITIONS PRIOR TO THE PCA EVENTS Final Report

Fred C. Jonah 17 Dec. 1965 89 p refs *Its.* Rept.-00.740 (Contract NAS9-4911)

(NASA-CR-65323) CFSTI: HC $3.00/MF $0.75 CSCL 04A

Solar and solar-induced terrestrial phenomena were analyzed a few days before and after the occurrence of solar flares which produced proton streams that were detected as polar cap absorption (PCA) events. These data were used as a basis for predicting dangerous radiation conditions outside the earth's atmosphere, their magnitude, and the time available for protective action. Plage regions, sunspot groups, flares, loop prominences, short wave radio fadeouts, solar radio emissions at discrete frequencies, and spectral emissions of Type II and Type IV that are reliably associated with PCA events were studied. It was found that if a proton event is observed, there is a high probability that the flare occurred in a large magnetically complex sunspot group, although such groups rarely have proton producing flares. Large bright and flare productive plage regions did not appear necessary for the production of a PCA-flare. A 3+ importance flare associated with a solar radio burst and short wave radio fadeout probably would be followed by a PCA event, as would a loop prominence associated flare. Solar magnetic conditions apparently do not influence flare proton delay time or magnitude. Recommendations for further observations are made. E.A.O

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N66-21142# Ritchie and Associates, Inc., Dayton, Ohio

INVESTIGATION OF "PREDICTOR" DISPLAYS FOR ORBITAL RENDEZVOUS—PROGRAM SUMMARY Final Report, Nov. 1963–Oct. 1964

George G. Frost (AMRL) and William K. Mc Coy, Jr. Wright-Patterson AFB, Ohio, AMRL, Sep. 1965 37 p refs Prepared jointly with AMRL

(Contract AF 33(615)-1089)

(AMRL-TR-65-138; AD-624467) CFSTI: HC $2.00/MF $0.5

A series of studies on the development of predictor display techniques for orbital rendezvous is summarized. The purpose of this program was to evaluate alternative predictive display techniques for orbital rendezvous. After an analog simulation of the rendezvous problem was mechanized and a display format developed, two studies were conducted investigating operator efficiency at control of rendezvous utilizing the side looking display format and predictor display techniques. Also, two display modifications were investigated: a reduced display size and, the addition of a braking circle. The results of the initial work indicated that operator performance in manual control of rendezvous maneuvers was enhanced by predictor display techniques. The final section of the report outlines the plans for follow-on efforts.

Author (TAB)

N66-21144# Joint Publications Research Service, Washington, D. C.

TIMELY PROBLEMS IN ASTRONOMY

Z. L. Ponizovskiy 23 Mar. 1966 10 p Transl. into ENGLISH from Priroda (Moscow), no. 12, Dec. 1965 p 93–95 (JPRS-34678; TT-66-31117) CFSTI: $1.00

Comments were made on the development of modern astronomy and on the role of amateur astronomers. They touched on the principal directions of astronomical research, including its purpose, the structure of the universe and the laws of its development. Included are discussions concerning the physical nature of celestial bodies, their chemical compositions, and the origin of the chemical elements. Galactic astronomy and the distribution of neutral hydrogen atoms in the galaxy were also mentioned, along with sunspots, solar radiation and solar chromospheric flares.

C.L.W.

N66-21145# Naval Observatory, Washington, D. C.

OBSERVATIONS OF THE SUN, MOON, AND PLANETS—SIX INCH TRANSIT CIRCLE RESULTS, 7 JUL.–24 DEC. 1964

A. N. Adams and D. K. Scott 1 Jul. 1965 9 p ref *Its* Circ. No. 108 (AD-626267) CFSTI: HC $1.00/MF $0.50

This Circular contains positions of the sun, moon, and planets observed with the Six-inch Transit Circle between 7 July, 1964 and 24 December, 1964. These results are provisional. Definitive results will be published later in a volume of Publications of the U. S. Naval Observatory.

TAB

N66-21160# Centre National de Recherches de l'Espace, Brussels (Belgium).

BIBLIOGRAPHY. II: INTERPLANETARY SPACE [BIBLIOGRAPHIE. II: ESPACE INTERPLANETAIRE]

[1964] 140 p refs *Its* Publ. no. 3b CFSTI: HC $4.00/MF $1.00

This interplanetary space bibliography encompasses publications on Mars, various other planets, comets and meteorites, cosmic radiation, gravitation and its effects, and the interplanetary space structure.

G.G.

N66-21161# Centre National de Recherches de l'Espace, Brussels (Belgium).

BIBLIOGRAPHY. II: INTERPLANETARY SPACE [BIBLIOGRAPHIE. II: ESPACE INTERPLANETAIRE]

[1964] 128 p refs *Its* Publ. no. 3a CFSTI: HC $4.00/MF $1.00

An interplanetary space bibliography is presented that contains numerous publications on Moon and Venus, as well as some studies on space plasmas, galaxies, stellar X-ray emission, etc.

G.G.

N66-21162# Centre National de Recherches de l'Espace, Brussels (Belgium).

BIBLIOGRAPHY. II: TERRESTRIAL SPACE [BIBLIOGRAPHIE. II: ESPACE TERRESTRE]

[1963] 209 p refs *Its* Publ. no. 4a CFSTI: HC $6.00/MF $1.25

The following topics are considered in this space bibliography volume: General aspects of space sciences; satellite space probes and astronomical observatories; meteorological space studies and weather forecasting; geomagnetic research activities; and auroral investigations.

G.G.

N66-21163# Centre National de Recherches de l'Espace, Brussels (Belgium).

BIBLIOGRAPHY. II: TERRESTRIAL SPACE [BIBLIOGRAPHIE. II: ESPACE TERRESTRE]

[1964] 122 p refs *Its* Publ. no. 4d CFSTI: HC $4.00/MF $1.00

This bibliography lists publications in the fields of orbital trajectory calculations, related mathematical problems of motion, celestial mechanics, photographic and visual satellite observations, etc.

G.G.

N66-21180# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.

LOW FREQUENCY RADIO ASTRONOMY EXPERIMENTS IN SPACE

N. Frank Six, Jr. Feb. 1966 39 p refs (R-180)

Radio astronomical observations made from the surface of the Earth are restricted at the high frequency end of the RF spectrum by the troposphere and at the low frequency end by the ionosphere. Artificial Earth satellites provide the means for eliminating these restrictions, but low frequency studies require large antennas, so a large stable platform is desirable. The surface of the Moon meets this requirement. In order to study the sources (Sun, Jupiter, radio stars, cosmic background, and perhaps Earth and Saturn) over the frequency range from 30 kHz to 10 MHz, the radiometer should be able to measure intensity, apparent position, apparent size, temporal variation, and polarization. The order of experiments will most likely be determined by the antenna system complexity and size. Early experiments on the lunar surface probably will employ simple broadband "pencil-beam" antennas. Man will be necessary for antenna installation and initial calibration.

Author

N66-21188# Defense Research Board, Ottawa (Ontario). Telecommunications Establishment.

ALOUETTE I TIME CHARTS, JANUARY–DECEMBER 1964

E. Dalgity 1 Feb. 1966 170 p CFSTI: HC $5.00/MF $1.00

A series of Alouette I satellite time charts is presented which provides a graphical indication of the duration of Alouette I operations for the period January, 1964 to December, 1964. Those operations include individual experiments, housekeeping, or combinations of these. The four primary experiments are the topside sounder, particle counter, vlf

receiver, and the cosmic noise receiver. All data were collected and telemetered in real time. The graphs are used to determine the availability of data in general or the availability of data obtained near a particular telemetry station. A listing of telemetry reception stations is included. E.A.O.

N66-21297# Case Inst. of Tech., Cleveland, Ohio. Warner and Swasey Observatory.
STUDY OF THE DISTRIBUTION OF HIGHLY LUMINOUS STARS IN OUR GALAXY Final Report
J. J. Nassau and C. B. Stephenson 6 Jan. 1966 14 p refs
(Contract Nonr-2797(00))
(AD-627185) CFSTI: HC $1.00/MF $0.50

The purposes of the investigations have been the following: (a) To conduct a search of the northern Milky Way for intrinsically luminous stars of early spectral type, to fainter apparent magnitudes than hitherto achieved systematically, (b) pursuant to point (a), to check and, if possible, improve existing methods of classifying low dispersion stellar spectra on objective-prism plates, (c) to test whether any gross features of galactic structure may be determined from the raw material of (a), and (d) to utilize the objective prism plates secured for part (a) for the identification of other spectra of unusual interest falling in the survey area. Author (TAB)

N66-21349*# Geological Survey, Washington, D. C.
ASTROGEOLOGIC STUDIES. PART C: COSMIC CHEMISTRY AND PETROLOGY Annual Progress Report No. 6, 1 Jul. 1964–1 Jul. 1965
Nov. 1965 124 p refs
(NASA Order R-66)
(NASA-CR-71413) CFSTI: HC $4.00/MF $1.00 CSCL 03B

Cosmic chemistry and petrologic investigations are reported on techniques of study, analysis, and interpretation of data on materials of known or suspected extraterrestrial origin. Included are a study describing the statistical treatment of superior analyses of tektites and the petrologic interpretation of the results, a study dealing with the petrologic significance of tektite analyses, minor element data for basaltic meteorites, a theoretical and experimental study of the stability of meteoritic cohenite as a function of temperature and pressure, and, as part of cosmic dust investigations, a report on the application of the scanning electron microscope and a progress report on the construction of laboratory facilities. R.N.A.

N66-21350*# Geological Survey, Washington, D. C.
ASTROGEOLOGIC STUDIES. PART A: LUNAR AND PLANETARY INVESTIGATIONS Annual Progress Report No. 6, 1 Jul. 1964–1 Jul. 1965
Nov. 1965 131 p refs
(NASA Order R-66)
(NASA-CR-71414) CFSTI: HC $4.00/MF $1.00 CSCL 03B

Astrogeologic studies are being conducted to determine and map the stratigraphy and structure of the lunar crust, to determine the sequence of events that led to the present condition of the lunar surface, and to determine the processes by which these events took place. This report contains the preliminary results of detailed geologic mapping of 15 new quadrangles on a scale of 1:1,000,000. The equatorial belt of the moon (32° N–32° S, 70° E–70° W) has now been completely mapped. Results of new mapping and of detailed studies of previously defined stratigraphic units are included. Photometric and polarimetric studies to supplement the mapping program are also presented. R.N.A.

N66-21352*# Boston Univ., Mass.
AN INVESTIGATION OF SCHROTER'S RULE Research Report No. 17
William J. Abrams Jan. 1966 20 p refs
(Grant NsG-246-62)
(NASA-CR-71416) CFSTI: HC $1.00/MF $0.50 CSCL 03B

The validity of using Schroter's Rule to evaluate theories of lunar crater formation is investigated. This rule states that the volume of material in the rim of a lunar crater is roughly equal to the volume of the depression formed below the surrounding ground level. A criterion was established to distinguish crater volume from rim volume, and to define the outer limits of the rim extension from the crater center. Values of rim volume, crater volume, ratio of rim volume to crater volume, and the probable error in the ratio were obtained for 39 lunar craters. Results show huge uncertainties in volume ratios generated by a seemingly small probable altitude error of 100 meters. This indicates that any statements concerning the ratio of rim volume to crater volume using less accurate means than those used in this study to obtain data are likely to be invalid, and that Schroter's Rule does not hold for the craters tested in this study. R.N.A.

N66-21353*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
WAKE OF THE MOON
D. P. Hoult [1965] 22 p refs
(Grant NsG-134)
(NASA-CR-71417) CFSTI: HC $1.00/MF $0.50 CSCL 03B

It is shown that the wake of the moon can be described by a closed set of moment equations derived from the Vlasov equations. The problem of the steady wake is solved. By comparison of the results with experiment it is shown that the wake must be unsteady. If the wake is turbulent, it is shown that such a turbulence possesses features not analogous to those which occur in a viscous fluid. By requiring that there be a non-linear cascade from larger scales, it follows that the mean magnetic field is small compared to the fluctuating magnetic field. This result is in agreement with observation. Author

N66-21394# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
SATELLITE SCINTILLATIONS OBSERVED DURING THE JULY 1963 SOLAR ECLIPSE
J. P. Mullen, J. Aarons, and J. M. Mott Dec. 1965 16 p refs
(AFCRL-65-914; AD-628056) CFSTI: HC $1.00/MF $0.50

During the solar eclipse of July 1963, observations of Transit 4A (1961 Omicron) were made for a period of three weeks at a site instrumented near Montreal, P. Q. When the results were correlated with those obtained at the Sagamore Hill Radio Observatory, Hamilton, Mass., it was found that the eclipse had no measurable effect on the scintillation pattern, confirming radio star observations at Sagamore Hill. Two examples of 'cloud' scintillation are described. Author (TAB)

N66-21439*# Texas Univ., Austin. Dept. of Mechanical Engineering.
AN IMPROVED MODEL FOR TWO-DIMENSIONAL TURBULENT BASE FLOW WITH ZERO MASS BLEED Summary Report
J. P. Lamb and C. S. Lenzo 28 Feb. 1966 36 p refs
(Contract NAS8-11482)
(NASA-CR-71527) CFSTI: HC $2.00/MF $0.50 CSCL 20M

A comprehensive theory is developed for turbulent base flows which can be used to treat multi-nozzle rocket geometries. The general approach was to begin with a comparatively simple two-dimensional geometry with isoenergetic flow and then gradually introduce additional complications in order to bring the model closer to actual rocket base flow conditions. Such a procedure is based on the hypothesis that a two-dimensional flow model can be devised whose dynamic and thermodynamic behavior is qualitatively the same as the actual multi-nozzle rocket. Detailed consideration is given to the expansion zone and mixing layer; mixing zone termination; the recompression region; and the reattaching shear layer displacement thickness. Included is an outline of the procedure used in calculating the base flow fields. C.T.C.

N66-21449# Joint Publications Research Service, Washington, D. C.

SOLAR AND STELLAR MAGNETIC FIELDS

Shih-Hui Yeh *In its* Transl. on Communist China's Sci. and Tech. 10 Mar. 1966 p 39–55 refs Transl. into ENGLISH from K'o Hsueh T'ung Pao (Peking), no. 12, Dec. 1965 p 1092–1101 (See N66-21446 11-30) CFSTI: $3.00

The development history of astrophysics, as the study on physical properties, compositions, structures, origin and evolution of heavenly bodies by measuring transverse and longitudinal stellar and solar magnetic fields is presented. A combination of electromagnetic phenomena and fluid motions determines their electromagnetic property parameters; magnetographic observations of the solar surface showed multipolar, irregular, and correlated local magnetic fields similar to the chromospheric structure observed by monochromatic images of Hα and KCa II. Observations of magnetic stars by the same methods were used for star classifications into: A type sharp line stars, metal line stars, M type giant stars, S type stars, and cluster variables. Studies on the interstellar magnetic field intensity established about 10^{-5} to 10^{-6} gauss as its optimal strength. Also outlined are some theories on the origin of the heavenly bodies' magnetic fields, and of the radiation transfer inside the magnetic field. G.G.

N66-21450# Joint Publications Research Service, Washington, D. C.

SURVEY OF ASTRONOMICAL CLIMATE AROUND PEKING AND SELECTION OF A SITE FOR THE PEKING OBSERVATORY

In its Transl. on Communist China's Sci. and Tech. 10 Mar. 1966 p 56–69 refs Transl. into ENGLISH from K'o Hsueh T'ung Pao (Peking), no. 12, Dec. 1965 p 1102–1110 (See N66-21446 11-30) CFSTI: $3.00

Astronomical climate conditions around Peking were evaluated for their number of sunny days, the atmospheric noise effects caused by fine variations in the refraction index through wave fluctuations, the transparency of the atmosphere, the background brightness of the sky, and other climatic effects that could effect astronomical observations. Also considered and compared were transportation and construction problems as well as geographical conditions. Finally, the construction site of Lien-yin-tsai was chosen as most suitable for the establishment of an astronomical laboratory near Peking. G.G.

N66-21475# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SCIENTISTS' LABORATORY IN SPACE

Oleg Shebalin 5 Nov. 1965 7 p Transl. into ENGLISH from Tekhn. Molodezhi (Moscow), no. 11, 1964 p 21 (FTD-TT-65-709/1+4; AD-627854) CFSTI: HC $1.00/MF $0.50

A generalized discussion is presented of some Russian accomplishments in space flight. TAB

N66-21566# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

COSMIC RESEARCH, VOLUME 3, NUMBER 5, 1965

20 Jan. 1966 237 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. III, no. 5, Sep.–Oct. 1965 p 667–809 (FTD-TT-65-1702/1+2; AD-627587) CFSTI: HC $6.00/MF $1.25

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2. STABILITY OF A STEADY-STATE ROTATION OF A SATELLITE ON AN ELLIPTICAL ORBIT A. P. Markeyev p 12–17 refs (See N66-21568 11-30)

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12. THE SOLAR FLARES OF 28 SEPTEMBER 1961 AND 20 MARCH 1958 A. A. Korchak p 135–151 refs (See N66-21578 11-29)

13. MEASUREMENT OF COSMIC RADIO EMISSION AT FREQUENCIES OF 210 AND 2200 kc AT DISTANCES UP TO 8 EARTH RADII ON THE ZOND 2 AUTOMATIC INTERPLANETARY STATION V. I. Slysh p 152–166 refs (See N66-21579 11-29)

14. RADIO-FREQUENCY MASS SPECTROMETER FOR THE "ELEKTRON" SATELLITES B. I. Zarkhin, V. G. Istomin, A. E. Rafal'son, and M. Ye. Slutskiy p 167–169 refs (See N66-21580 11-14)

15. SHIELDING AN ASTRONAUT AGAINST ELECTRONS AND BREMSSTRAHLUNG IN THE TERRESTRIAL RADIATION BELT Ye. Ye. Kovalev, D. P. Osanov, G. B. Radziyevskiy, and A. D. Mel'nik p 190–202 refs (See N66-21581 11-05)

16. RADIOBIOLOGICAL EFFECTS IN ANIMALS PREVIOUSLY SUBJECTED TO ACCELERATION B. I. Davydov, V. V. Antopov, N. I. Konnova, and P. P. Saksonov p 203–215 refs (See N66-21582 11-04)

17. INFLUENCE OF CERTAIN SPACEFLIGHT FACTORS ON THE HEREDITARY STRUCTURES OF MAMMALS M. A. Arsen'yeva, L. A. Belyayeva, Yu. S. Demin, G. L. Pokrovskaya, A. V. Golovkina et al p 216–234 refs (See N66-21583 11-04)

N66-21567 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ASYMPTOTICALLY STABLE STEADY-STATE ROTATIONS OF A SATELLITE

V. A. Sarychev *In its* Cosmic Res., Vol. 3, No. 5 20 Jan. 1966 p 1-11 refs (See N66-21567 11-30) CFSTI: HC $6.00/MF $1.25

Steady-state, in the orbital coordinate system, rotations of an axisymmetric satellite on a circular orbit are investigated. A proposal is given for a method of introducing controlling moments that makes it possible to produce asymptotically stable steady-state rotations. The stability conditions of the solutions obtained are analyzed, and the results of numerical calculations are given. In the appendix, we examine the influence of ellipticity of the orbit on the steady-state rotations of the satellite. Author

N66-21568 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STABILITY OF A STEADY-STATE ROTATION OF A SATELLITE ON AN ELLIPTICAL ORBIT

A. P. Markeyev *In its* Cosmic Res., Vol. 3, No. 5 20 Jan. 1966 p 12-17 refs (See N66-21566 11-30) CFSTI: HC $6.00/MF $1.25

The stability of steady-state rotation of a dynamically symmetrical satellite about the normal to the plane of an elliptical orbit is investigated. Regions of parametric resonance are obtained accurate to the first power of the eccentricity. Author

N66-21569 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF PLANE BENDING OSCILLATIONS OF A GRAVITATIONALLY STABLE SATELLITE-PLUS-STABILIZER SYSTEM

V. I. Popov and V. Yu. Rutkovskiy *In its* Cosmic Res., Vol. 3, No. 5 20 Jan. 1966 p 18-29 refs (See N66-21566 11-30) CFSTI: HC $6.00/MF $1.25

Equations are derived for plane bending oscillations of a satellite/stabilizer system. Possible perturbations following deployment of the stabilizer are determined, and the resulting equations of motion are studied. Author

N66-21570 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A REMARKABLE PROPERTY OF A BUNDLE OF HYPERBOLIC TRAJECTORIES

A. A. Deshkov and V. V. Ivashkin *In its* Cosmic Res., Vol. 3, No. 5 20 Jan. 1966 p 30-33 (See N66-21566 11-30) CFSTI: HC $6.00/MF $1.25

The paper deals with a property of a bundle of hyperbolic trajectories of a material point about a planet whose axial trajectory passes through the center of the planet. This property enables us to determine the orientation of the velocity vector at a given point of the bundle trajectory independently and with a high degree of accuracy from the vertical to the planet at a fixed distance from its center. Trajectories at the Earth, the Moon, Mars and Venus are presented as examples. This property of a trajectory bundle may be exploited in the design of self-contained navigation systems for use near planets. Author

N66-21571 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

OPTIMUM ROTATION OF THE PLANE OF A CIRCULAR ORBIT BY A TRANSVERSE FORCE

Yu. N. Ivanov and Yu. V. Shalayev *In its* Cosmic Res., Vol. 3, No. 5 20 Jan. 1966 p 34-44 refs (See N66-21566 11-30) CFSTI: HC $6.00/MF $1.25

A solution is given for the variational problem of rotation of a circular orbit plane through a given angle for a given position of the line of nodes under the influence of a transverse thrust force. The direction and magnitude of the thrust are programmed in such a way that the rotation is accomplished with minimal weight loss. The latter is determined by the type of engine system; here we consider ideally controllable engines of limited power and noncontrolled engines. Author

N66-21572 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOLUTION OF THE THREE-BODY PROBLEM IN SERIES FORM

A. N. Bogayevskiy *In its* Cosmic Res., Vol. 3, No. 5 20 Jan. 1966 p 45-51 ref (See N66-21566 11-30) CFSTI: HC $6.00/MF $1.25

A solution is given to the three-body problem in the form of power series in the time t (Taylor series). The coefficients of these series are sums of explicit algebraic expressions of the initial conditions with coefficients that depend only on the attracting masses. The latter are given by recurrent relationships. Author

N66-21573 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE PERTURBING MOMENT OF A SATELLITE MOVING IN THE EARTH'S MAGNETIC FIELD

A. D. Shevnin *In its* Cosmic Res., Vol. 3, No. 5 20 Jan. 1966 p 52-65 refs (See N66-21566 11-30) CFSTI: HC $6.00/MF $1.25

With the dipole approximation of the Earth's magnetic field as a point of departure, we evaluate the signs of the field-strength components in the orbital system of coordinates and establish the shape of the surface described by the field-strength vector about the binormal to a satellite orbit. The relative change in the field due to the ellipticity of the orbit is cited, together with the error of the dipole approximation. A working formula for arbitrary direction of the magnetic moment is derived for determination of the scalar magnitude of the satellite magnetic moment from a given perturbing moment and known values of the field-strength

components. In conclusion, we consider the perturbing moments of the satellite due to magnetically hard and magnetically soft iron and current-carrying coils. Author

N66-21635*# Geological Survey, Washington, D. C.
ASTROGEOLOGIC STUDIES—SUMMARY Annual Progress Report, 1 Jul. 1964–1 Jul. 1965
Nov. 1965 34 p refs
(NASA Order R-66)
(NASA-CR-71419) CFSTI: HC $2.00/MF $0.50 CSCL 03B

This report summarizes the results of lunar and planetary studies, crater and solid state investigations, and cosmic chemistry and petrology research which were conducted to determine and map the stratigraphy and structure of the lunar crust, to determine the sequence of events that led to the present condition of the lunar surface, and to determine the processes by which these events took place. Part A contains results of detailed geologic mapping of 15 new lunar quadrangles at a scale of 1:1,000,000. Results of new mapping of both volcanic and impact features and detailed studies of previously defined stratigraphic units are included. Systematic photometric, polarimetric, and infrared studies designed to asssist in the geologic mapping are discussed and a proposed method of improving selenodetic control by laser radar ranging is described. Part B contains the results of field and laboratory studies of crater phenomenology, including volcanic, explosive, and impact events. Part C includes reports dealing with the techniques of study, the analysis, and the interpretation of data on materials of known or suspected extraterrestrial origin. R.N.A.

N66-21679*# Harvard Coll. Observatory, Cambridge, Mass.
MODELS OF THE LUNAR SURFACE INCLUDING TEMPERATURE-DEPENDENT THERMAL PROPERTIES Scientific Report No. 8
Jeffrey L. Linsky 15 Jan. 1966 90 p refs
(Grant NsG-64-60)
(NASA-CR-71554) CFSTI: HC $3.00/MF $0.75 CSCL 03B

The thermal conditions in the lunar surface are considered on a gross scale in terms of models with temperature-dependent thermal properties, including radiative energy transport. Agreement is obtained with infrared measurements of cold terminator temperatures and radio lunation data at millimeter wavelengths for a range of postulated parameters of the surface material. The observed increase of mean radio brightness temperature with wavelength is interpreted as due to radiative energy transport and the resultant nonlinearity of the heat-conduction equation, rather than to a large radioactive heat flux. The postulated existence of radiative energy transport is consistent with a porous or frothy medium, in agreement with photometric and laboratory simulation experiments, as well as with recent radar depolarization measurements. A distance scale of 0.1–0.3 mm for the effective mean separation of radiating surfaces is suggested by this interpretation of the data. Author

N66-21726*# Texas Instruments, Inc., Dallas. Science Services Div.
SURVEY OF LUNAR SURFACE MEASUREMENTS, EXPERIMENTS AND GEOLOGIC STUDIES Final Report
30 Aug. 1964 697 p refs
(Contract NAS9-2115)
(NASA-CR-65313) CFSTI: HC $9.97/MF $3.25 CSCL 03B

This survey on possible measurements, experiments, and geological studies of the lunar surface gives primary consideration to experiments on: gravitational, magnetic, electromagnetic, and electrical fields; seismicity; planimetric and elevational position; composition and age of lunar material; geochemical and geonuclear properties; soil mechanics and properties; surface geometry; temperature; stratification and density; and radiation, particle and micrometeoroid flux. Lunar surface measurements are grouped according to their hazards to the astronaut; their trafficability; lunar basing; origin, history, and age of the lunar surface; and origin, history, and age of the earth-moon system. Maximum emphasis during the first landing is placed on measurements related to astronaut safety and future mission success. Data for all experiments and instruments are compiled prior to selection for specific missions; implanting and activating a scientific instrument package to monitor phenomena subsequent to astronaut departure is recommended. G.G.

N66-21766*# System Sciences Corp., Falls Church, Va.
GEOS A READINESS TEST EVALUATION REPORT
H. G. Gross Feb. 1966 165 p refs *Its* Tech. Memo. 4007–4
(Contract NASw-1238)
(NASA-CR-71623) CFSTI: HC $5.00/MF $1.00 CSCL 22A

Results of the readiness tests, conducted before and after launch of the geodetic earth orbiting satellite, are reported. Details of the test operations, and recommendations are given for each of the following areas: international participants; optical predictions teletype simulation; simulated MVE list distribution; optical operational readiness; and Rosman backup injection station test. The optical tracking participation was emphasized. The tests were considered to be particularly beneficial in exercising the complex facilities before actual operations commenced, as they provided operational practice and corrected conflicts in data formats and operations. Other benefits mentioned were the verification of communications access to the distribution points, and subsequent modification of data formats. N.E.N.

N66-21767*# Geophysics Corp. of America, Bedford, Mass. GCA Technology Div.
CONTRIBUTIONS TO PLANETARY METEOROLOGY Final Report
George Ohring, Wen Tang, Frederick B. House, and Joseph Mariano Mar. 1966 87 p refs
(Contract NASw-1227)
(NASA-CR-71627; GCA-TR-66-8-N) CFSTI: HC $3.00/MF $0.75 CSCL 03B

Reports are given on meteorological investigations of Mars and Venus. The steady state, axially symmetric case of the general circulation of the Martian atmosphere was considered. It was concluded that the symmetrical regime cannot remain stable. A simple theoretical model was formulated to investigate the Martian latitudinal and seasonal variation of the surface and mean atmospheric temperatures, and the atmospheric heat transport effect on the temperature climate is discussed. The water vapor mixing ratios near the cloud-tops of Venus were studied, assuming a water vapor mixing ratio which decreases with altitude at rates comparable to those in the earth's upper troposphere. It was concluded that some of the observed amounts of water vapor are compatible with the presence of aqueous clouds. A diffusion model was developed to study the interhemispheric water vapor transport and the Martian ice caps. It is suggested that this transport requires a large scale eddy diffusion coefficient, and that this size coefficient leads to meridional speeds of water vapor isopleths that are in good agreement with the observed speed of darkening wave propagation. N.E.N.

N66-21773*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE SITUATION REPORT, VOLUME 6, NO. 3
15 Feb. 1966 27 p Prepared in cooperation with NORAD and the Smithsonian Astrophys. Obs.
(NASA-TM-X-57324; X-512-66-51) CFSTI: HC $2.00/MF $0.50 CSCL 20A

Data were computed and compiled on objects in orbit from 1958 to 1200Z on February 15, 1966. The tabulations include the period, inclination, apogee, perigee, and transmitting frequency. N.E.N.

N66-21782*# Boston Univ., Mass.
CATALOGUE OF LUNAR CRATERS CROSS SECTIONS. I: CRATERS WITH PEAKS Research Report No. 16
Gerald S. Hawkins, William H. Zack, and Stephen M. Saslow Sep. 1965 115 p *Its* Astron. Contrib., Ser. II, no. 41
(Grant NsG-246-62)
(NASA-CR-71543) CFSTI: HC $4.00/MF $0.75 CSCL 03B

Graphical and digital representations of lunar craters possessing centrally located peaks are presented. Two to eight profiles were drawn for each peaked crater and digital tables compiled by interpolating data from the profiles. N.E.N.

N66-21861# Lockheed Missiles and Space Co., Sunnyvale, Calif.
DETERMINATION OF THE STOCHASTIC CHARACTERISTICS OF PERTURBED MOTION PARAMETERS OF AN ARTIFICIAL EARTH SATELLITE
I. V. Ignatov [1965] 10 p refs Transl. into ENGLISH from Prikl. Mekhan. i Tekhn. Fiz. (USSR), v. 1, no. 12, 1965 p 82–86

The stochastic characteristics of the parameters of the osculating ellipse are determined for satellites in which the perturbing effect of the sun and moon may be neglected, and the atmospheric drag was taken as the fundamental force effect. Approximate formulas were obtained which permit the determination of the mathematical expectation and variance for the parameters of the osculating ellipse at any turn of the satellite depending on the random deflections of the initial orbital parameters a and e for $0.01 < e < 0.1$. Specifically, the problem is posed herein of an approximate determination of the stochastic characteristics of the perturbed orbit parameters of an artificial earth satellite, which are a result of the random deviations of the terminal parameters of the injection phase, the presence of drag of the medium, the assumption of a central gravitational field described by a Newtonian potential, and the absence of rotation of the atmosphere relative to the earth (in the inertial coordinate system). Numerical computations were made on a BESM-2M type computer to determine the stochastic parameters of the osculating ellipse in the n-th turn of a satellite. The results of the computations are summarized. M.R.W.

N66-21873# Douglas Aircraft Co., Inc., Tulsa, Okla.
INTERFACE THERMAL CONDUCTANCE TESTS OF RIVETED JOINTS IN A VACUUM, JULY 1963–NOVEMBER 1963
R. R. Anderson 6 Feb. 1964 55 p refs
(TU-24871)

This report presents the results of an experimental investigation of the interface thermal contact conductance of typical missile/space vehicle structural joints in a vacuum. Test data are presented in both tabular and graphical form for four typical skin-stringer configurations. Three specimens of each configuration were tested in order to determine the effects of manufacturing variability. In addition, three test runs were made on each specimen in order to determine the effect of heating history. The interface conductance was determined for several time intervals in each run. Measured values of interface conductance ranged from a maximum of 1295 to a minimum of 71 Btu/hr-ft^2-°F. The average value of interface conductance was 341.4 Btu/hr-ft^2-°F. This value includes the effects of heat flow rate, manufacturing, variability, mean interface temperature, and joint surface treatment. The average value and the range of values observed during this test series is in general agreement with the values of thermal conductance of riveted joints observed by other investigators. It is concluded that the thermal conductance of a riveted joint usually decreases with heating history and increasing mean interface temperature. Author

N66-22093# Sandia Corp., Albuquerque, N. Mex.
AN INTRODUCTION TO THE TTA GENERALIZED RIGID BODY TRAJECTORY PROGRAM FOR DIGITAL COMPUTER
J. A. F. Allensworth May 1965 40 p
(Contract AT(29-1)-789)
(SC-DR-65-271) CFSTI: HC $1.00/MF $0.50

Much valuable information concerning the movement of bodies in space can be obtained by the computation of theoretical trajectories. The TTA program was designed to meet the developing requirements for trajectories. TTA permits requesting the trajectory by means of a flexible language which is similar to English. The language and data structure of TTA places a useful tool into the hands of the user. Author (NSA)

N66-22105# Sandia Corp., Albuquerque, N. Mex.
SANDIA CORPORATION EXPEDITION FOR AIRBORNE SCIENTIFIC OBSERVATION OF THE ECLIPSE OF THE QUIET SUN OF MAY 30, 1965
N. C. Anderholm Sep. 1965 48 p refs
(Contract AT(29-1)-789)
(SC-M-65-419) CFSTI: HC $2.00/MF $0.50

The preparations for and operations of expedition to observe the total solar eclipse of May 30, 1965 are described. Of the other observations made on the expedition, brief summaries are given on the measurements of the cosmic ray induced neutron flux and the twinkle experiment. Brief statements of expected results are included. Author (NSA)

N66-22167*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
[STUDIES IN THE 11 METER RANGE OF RADIO ASTRONOMY USING HIGH RESOLUTION AND HIGH SENSITIVITY ANTENNA ARRAYS AT CLARK LAKE] Final Report
W. C. Erickson [1965] 66 p refs
(Grant NsG-615)
(NASA-CR-71421) CFSTI: HC $3.00/MF $0.75 CSCL 03A

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N66-22168* Maryland Univ., College Park. Dept. of Physics and Astronomy.

TWO LUNAR OCCULTATIONS OF THE CRAB NEBULA

B. L. Gotwols, W. C. Erickson, E. Fremouw, and L. Owren (Alaska Univ.) *In its* Studies in the 11 Meter Range of Radio Astronomy Using High Resolution and High Sensitivity Antenna Arrays at Clark Lake [1965] 15 p refs (See N66-22167 11-30) CFSTI: HC $3.00/MF $0.75

Interferometric observations on two lunar occultations of the Crab Nebula from College, Alaska, were analyzed. Radiofrequencies monitored on May, 1964, were 26.3, 68, 223, and 456 MHz, and July, 1964, observed frequencies were 26, 136, 223, and 456 MHz. Transmission lines for simultaneous observations on all frequencies were not available. Results indicated that the angular size of star Tau A is approximately constant with increasing frequency at observations above 100 MHz. The shift of the radio centers from the optical center was not greater than ~0.4'. Observations at 68 MHz were spoiled by solar contamination, and the 26 MHz observation was spoiled by ionospheric scintillation and radiostar interference. The angular sizes of Tau A at 136, 223, and 456 MHz are all comparable and showed radio centers coincident with optical centers. G.G.

N66-22169* Maryland Univ., College Park. Dept. of Physics and Astronomy.

11.4 METER WAVELENGTH OBSERVATIONS WITH 4 ARC MINUTE RESOLUTION

William C. Erickson *In its* Studies in the 11 Meter Range of Radio Astronomy Using High Resolution and High Sensitivity Antenna Arrays at Clark Lake [1965] 3 p ref (See N66-22167 11-30) CFSTI: HC $3.00/MF $0.75

Transits of Cyg A were observed by a four mile extended E-W grating array of the Clark Lake Antenna on November 11 and 13, 1965. Fan-beam patterns of the transits yielded an average observed halfwidth of 4'.5. This observed broadening from the standardized antenna response of 4'.0 halfwidth E-W and 3° halfwidth N-S showed the expected response for an assumed 2' wide Cyg A. Signals maintained good phase correlations over the long baseline and did not appear unduly disturbed by ionospheric scintillations. G.G.

N66-22175*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE POSSIBILITY OF RADIO NOISE FROM THE LUNAR RED SPOTS

John A. O'Keefe [1965] 4 p refs Submitted for Publication (NASA-TM-X-56088) CFSTI: HC $1.00/MF $0.50 CSCL 03A

The explanation of small red spots near Aristarchus and other lunar craters is discussed. Based on observations of molecular hydrogen lines in the spectrogram of the spot near Aristarchus, it is suggested that the red spots are produced by static electric discharges through the H_2 which emerges above small lunar ash flows. It is concluded that the static electrical discharges, or lunar lightning, could produce radio noise of an order of magnitude within the capability of radio telescopes. N.E.N.

N66-22180*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ANALYSIS OF A SIMPLE TECHNIQUE FOR ESTABLISHING LUNAR ORBITS

L. Keith Barker and Gene W. Sparrow [1965] 13 p Presented at the AIAA 2d Ann. Meeting and Tech. Display, San Francisco, 26–29 Jul. 1965

(NASA-TM-X-56506) CFSTI: HC $1.00/MF $0.50 CSCL 22C

An analytical study has been made of a simplified guidance technique designed to place the spacecraft that departs from earth in a close orbit around the moon. The technique consists of maintaining a constant angle between the thrust axis of the spacecraft and the line of sight to the lunar horizon nile the orbit is being established. The nominal approach trajectory which was used had a transit time of 70.5 hours, a minimum altitude of 80 nautical miles, and a velocity at this point of 8308 feet per second. It was found that parking orbits which are closely confined to the pericynthion altitude of the approach trajectory (80 n. mi.) can be established very efficiently by use of the simplified guidance technique. Author

N66-22217*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.

GRAVITATIONAL RADIATION FROM A SPINNING ELLIPSOID OF UNIFORM DENSITY

Chao-Wen Chin 26 Mar. 1965 10 p refs Submitted for Publication

(NASA-TM-X-56447) CFSTI: HC $1.00/MF $0.50 CSCL 03B

The gravitational radiation from a spinning ellipsoid and a spinning ellipse of uniform density is calculated. Upon comparison, the numerical coefficients are found to be smaller than that for a spinning rod. Radiation power vanishes when the ellipsoid and the ellipse are reduced to a spheroid and a circle respectively. A classical rotating mass of uniform density bound by its gravitational field may be shown to be unstable against bifurcation into an ellipsoid if the period of rotation is short enough. Gravitational radiation can dissipate the angular momentum when bifurcation takes place. The calculation is used to estimate the energy loss rate of a collapsing neutron star. It is shown that the relaxation time for dissipating angular momentum is around one second. Author

N66-22218*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.

THE GREENHOUSE EFFECT IN A GRAY PLANETARY ATMOSPHERE

Rupert Wildt 3 Jun. 1965 16 p refs Submitted for Publication

(NASA-TM-X-56621) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Hopf's analytical solution is illustrated for several values of the greenhouse parameter, i.e., the ratio of gray absorption coefficients for insolating and escaping radiation, assumed to be constant at all depths. Author

N66-22230*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COSMOGENIC RADIONUCLIDES IN THE BONDOC METEORITE

Philip J. Cressy, Jr. 12 Arp. 1965 9 p refs Submitted for Publication

(NASA-TM-X-56419) CFSTI: HC $1.00/MF $0.50 CSCL 13G

Long-lived cosmogenic radionuclides were measured in the stone phase and a mechanically separated metallic nodule from a fragment of the Bondoc mesosiderite. Activity levels of the various radionuclides in both phases, along with results of mass spectrometric measurements of rare gas isotopes in the stone phase, indicate that heavy shielding was the chief cause of the observed low specific activities. Author

N66-22235*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TEKTITES AS A GUIDE TO THE STRUCTURE OF THE MOON

John A. O'Keefe and Paul D. Lowman, Jr. [1965] 20 p refs Submitted for Publication

(NASA-TM-X-56663) CFSTI: HC $1.00/MF $0.50 CSCL 03B

This paper attempts to prove the lunar origin of tektites which then can be used to analyze the lunar surface. Evidence and arguments are presented which support the view that tektites are the products of meteorite impact on the moon which have been captured by the earth. Several large tektite strewfields are described and theories for both earth and lunar impact origins are discussed. Comparisons are made between Ranger photographs and similar earth features to lend support to the lunar origin of tektites. The speculations offered, though plausible, are concluded to be no more than speculations as there is no way of confirming that the lunar surface is genuinely like tektites in its chemical composition, short of obtaining an actual lunar sample. R.N.A.

N66-22239*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OBSERVED ULTRAVIOLET REFLECTIVITY OF MARS

Dennis C. Evans [1965] 18 p refs Submitted for Publication

(NASA-TM-X-56654) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Ultraviolet spectrograms of Mars (2400–3500 Angstroms, ~50 Angstrom resolution) have been obtained using an objective grating spectrograph on an Aerobee rocket. The data indicate a reflectivity of 0.04 to 0.08 in the ultraviolet, increasing toward shorter wavelength according to a Rayleigh Law. The data can be represented by an N_2:CO_2:A model atmosphere with a surface pressure of about 5 to 20 millibars. The photographic appearance of the planet in the blue is interpreted as a loss of surface contrast and reflectivity rather than by absorption in the atmosphere by the "blue haze". The model predicts the general appearance of the planet in the photographic ultraviolet, blue, visible, and red. There are serious biological implications since the model predicts that ultraviolet radiation (2000–3000 Angstroms) will reach the surface. Author

N66-22241*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ON GRAPHITE AND INTERSTELLAR EXTINCTION

Theodore P. Stecher and Bertram Donn [1965] 5 p refs Submitted for Publication

(NASA-TM-X-56630) CFSTI: HC $1.00/MF $0.50 CSCL 03B

This paper presents evidence to further support the contention that graphite particles are responsible for interstellar extinction. Mie scattering calculations were conducted on graphite using the measured values of the complex index of refraction corresponding to 17 wavelengths in the calculation for spherical particles. The Oort-van de Hulst size distribution was used to obtain an integrated cross section for extinction. The steps were in terms of 0.8×10^{-6} cm for the particle radius with the 1/eth value of the frequency function being 5.6×10^{-6} cm. This curve is compared with the mean observed interstellar extinction of Boggess and Borgman and previously reported observational results. The maximum in the theoretical extinction curve at $\lambda^{-1}=4.4$ inverse microns is the graphite signature. This maximum rapidly increases as the relative size of the particle radius decreases. At the same time, the extinction for $\lambda^{-1}<2$ decreases. A 50% increase in the relative radius of the particles appears sufficient to produce the variation in the ratio of selective to total extinction. A maximum in the observed interstellar extinction curve also occurs at $\lambda^{-1}=4.4$ microns. This coincidence provides a strong argument in favor of graphite. R.N.A.

N66-22243*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ASTRONOMICAL ULTRAVIOLET RADIATION

Kenneth L. Hallam Mar. 1965 40 p refs Submitted for Publication

(NASA-TM-X-56421; X-614-65-106) CFSTI: HC $2.00/MF $0.50 CSCL 03A

This paper is concerned with the astronomical study of ultraviolet radiation. It begins with a general discussion of observational astronomy, ultraviolet observations, the galactic composition, and extragalactic systems. This is followed by a more detailed look at the interstellar medium, in particular, molecular and atomic hydrogen, the interstellar chemical composition and ionization, and particulate matter. Stellar radiation is examined in terms of stellar relationships, stellar atmospheres, stellar ultraviolet observations, and extragalactic ultraviolet radiation. Finally, the instrumentation for measuring ultraviolet radiation using sounding rockets, satellites, and space laboratories is discussed. R.N.A.

N66-22260*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EXTENSION OF THE PHOTOSPHERIC MAGNETIC FIELD INTO INTERPLANETARY SPACE

Norman F. Ness and John M. Wilcox (Calif. Univ., Berkeley) Feb. 1965 36 p refs Submitted for Publication

(NASA-TM-X-56170; X-612-65-79) CFSTI: HC $2.00/MF $0.50 CSCL 03B

Observations of the nearby interplanetary magnetic field by the magnetometer experiment on the artificial Earth satellite IMP-1 have been compared with observations of the photospheric magnetic field obtained with the solar magnetograph at the Mt. Wilson Observatory. A good correlation has been found between the large scale pattern of the direction (into or out of the sun) of the photospheric field and the pattern of the direction (toward or away from the sun) of the nearby interplanetary field. This substantiates the theoretical model of the transport of solar magnetic fields into interplanetary space by the magnetohydrodynamic expansion of the solar corona. Author

N66-22276*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A METHOD OF APPROXIMATING PROPELLANT REQUIREMENTS OF LOW-THRUST TRAJECTORIES

Charles L. Zola Washington, NASA, Apr. 1966 53 p refs

(NASA-TN-D-3400) CFSTI: HC $0.80/MF $0.50 CSCL 22C

An approximation method for calculation of optimum trajectory solutions for low-acceleration flight in an inverse-square gravitational field is presented. This method is based on the dynamic similarity between flight on an optimum trajectory in the inverse-square field and rest-to-rest flight on a rectilinear path in gravity-free space. Consequently, the equivalent rectilinear path length L becomes a measure of the propulsive effort of trajectories similar to the characteristic velocity increment ΔV. Examples of the use and validity of the method are given for different types of interplanetary trajectory problems. When applied to typical circular orbit transfer problems, the approximation method can predict ΔV with an error of 10 percent or less. It is shown that errors in the method are most serious for flyby trajectories, becoming as large as 40 percent in terms of ΔV. However, typical specific impulse values for low-acceleration flight reduce the ΔV error by a factor of two or more when translated into error in propellant consumption. The possibility of improving accuracy is discussed, and it is shown that a more general (and more complicated) type of rectilinear flight with nonzero velocities at the terminals may be required.

Author

N66-22277*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A METHOD OF TRAJECTORY OPTIMIZATION BY FAST-TIME REPETITIVE COMPUTATIONS

Rodney C. Wingrove, James S. Raby, and D. Francis Crane Washington, NASA, Apr. 1966 22 p refs

(NASA-TN-D-3404) CFSTI: HC $0.30/MF $0.50 CSCL 22C

This report presents a perturbation method of computing optimum trajectories wherein control impulse response functions are determined by fast-time repetitive computations of the state equations. This method does not require the solution of the auxiliary set of adjoint equations used with other perturbation methods. The mechanization of this computing method on a hybrid computer is discussed and an application to the steepest descent optimization of reentry trajectories is presented. In this example, the vehicle is to arrive at a desired range, the heat input to the vehicle is to be minimized, and the control is to remain within specified constraints. Optimum trajectories for this example could be obtained in about 8 minutes of computing time. Author

N66-22343* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SATELLITE SHADOW TIME

P. E. Dreher *In its* Aero-Astrodyn. Res. Rev. No. 3 15 Oct. 1965 p 102-107 refs (See N66-22329 11-34) CFSTI: HC $4.00/MF $1.00

Analytical methods have been developed to determine the time spent in shadow by an earth orbiting satellite. The length of the shadow time is a function of the particular orbit under consideration (i.e., semimajor axis and eccentricity) and of the orientation of the orbit with respect to the sun. A general parameter study for two different orbits was performed. The umbra transit times are as great as 12 hours for certain orbit orientations and less than 0.5 hour for other orientations. The penumbra transit time is generally less than 30 percent of the umbra transit time. The effects of the refraction of the sun's rays by the earth's atmosphere on these transit times can be significant. Since the refraction method has not been incorporated in the computer program, only one case was evaluated. For this particular case the umbra transit time was reduced approximately 300 percent. Author

N66-22348*# Franklin Inst., Philadelphia, Pa. Research Labs.

STUDY OF DESIGN PARAMETERS OF EXPLOSIVE INITIATORS WITH RESPECT TO SPACE ENVIRONMENTS Final Report

Raymond G. Amicone and Paul F. Mohrbach Dec. 1965 122 p refs

(Contract NAS9-4042)

(NASA-CR-65325; F-B2333) CFSTI: HC $4.00/MF $1.00 CSCL 22A

In a study to anticipate and correct potential problems with explosives and explosive triggering devices, information was gathered on the environmental conditions which will be encountered on manned space flights. Such parameters and factors were considered as space flight duration, temperature and pressure, electromagnetic radiation, static electricity and sparks, nuclear particles, chemicals, shocks, and vibration. Based on these factors, it was concluded that only trips into the Venus atmosphere would present serious problems because of predicted high temperatures and pressures.

D.T.

N66-22376*# General Dynamics/Fort Worth, Tex.

A STUDY OF JUPITER FLYBY MISSIONS Mid-Term Technical Report

17 Feb. 1966 379 p Prepared for JPL

(Contracts NAS7-100; JPL-951285)

(NASA-CR-71844; FZM-4572) CFSTI: HC $7.00/MF $3.00 CSCL 22A

Results of preliminary studies to develop spacecraft design concepts for a flyby mission of the planet Jupiter are reported. The characteristics of Earth–Jupiter transfer trajectories during the time period 1973 to 1980 were investigated. Studies were conducted in the areas of communications, data management, navigation and guidance, spacecraft control, mid-course propulsion, attitude control, and power. A detailed discussion of these studies is included. Five launch vehicles were evaluated in relation to the energy requirements for Jupiter flyby missions. Mission planning and payload versus flight time charts were constructed for each launch vehicle considered. Four spacecraft design concepts evolved during the course of the studies. A description of these concepts is provided. Appended are mission maps, a parametric analysis of the basic hydrazine propulsion system, a discussion of meteroid damage to spacecraft antennas, and a parametric analysis of a cold gas attitude control propulsion subsystem.

H.S.W.

N66-22384# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.

BIBLIOGRAPHY OF LUNAR AND PLANETARY RESEARCH, 1960–1964

J. W. Salisbury, ed. Jan. 1966 530 p refs *Its* Spec. Rept.-40 (AFCRL-66-52; AD-628792) CFSTI: HC $8.30/MF $2.25

A bibliography of lunar and planetary research articles published during the time period 1960–1964 is presented with both subject and author listings. The major subject categories are: astrobiology, comets, meteorite craters and cratering effects, meteors and meteorites, the moon, origin of the solar system, the planets, and tektites. Each article is abstracted.

Author (TAB)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N66-21183# British Aircraft Corp., Stevenage (England) Guided Weapons Div.

THE STRUCTURE OF UK3

J. L. Blonstein [1965] 28 p ref Presented at the CNES Symp. on the Struct. of Satellites, Paris, Jun. 1965

CFSTI: HC $2.00/MF $0.50

The structural design of the UK3 British research satellite is reviewed, along with some results of structural tests and their effects on the design. Satellite shape and general construction are discussed, and special emphasis is given to body design, boom design, and boom erection dynamics. Problem areas included vane failure in the body structure after vibration testing due to lack of rigid support, weight control, and boom damping mechanisms after boom extension. Metallic materials used in the satellite, and their properties are listed in tabular form. E.A.O.

N66-21425# Space Technology Labs., Inc., Redondo Beach, Calif.

INVESTIGATION OF THE ACQUISITION PROBLEM IN SATELLITE ATTITUDE CONTROL Final Report, 1 Apr. 1964–31 Mar. 1965

A. E. Sabroff, R. L. Farrenkopf, A. M. Frew, and M. H. Gran Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Dec. 1965 319 p refs

(Contract AF 33(615)-1535)

(STL-4154-6008-RU001; AFFDL-TR-65-115; AD-628062) CFSTI: HC $7.00/MF $1.50

The acquisition function of a spacecraft attitude control system consists of properly orienting the vehicle with respect to specified reference directions starting from large initial attitude and rate errors. The resulting control system design problem was examined by establishing suitable mathematical representations, comparing competing control concepts, developing a practical optimization approach, and evaluating a new technique for applying Lyapunov stability theory to the acquisition problem. Author (TAB)

N66-21595# Rome Univ. (Italy). School of Aerospace Engineering.

THE INFLUENCE OF THE WEIGHT OF THERMIC SCREENS ON THE UTILITY OF MULTISTAGE ROCKETS [L'INFLUENZA DEL PESO DEGLI SCHERMI TERMICI SULLE PRESTAZIONI DEI RAZZI POLISTADI]

Severino Giorgi Oct. 1964 32 p refs In ITALIAN; ENGLISH summary

(Rept.-7) CFSTI: HC $2.00/MF $0.50

This report provides the determination of the maximum altitude that a sounding rocket can reach as a function of the kinetic heating of the nose. The formulation of the problem avoids any linearization, and its study, carried out in a rigorous but simplified way, comes to a numerical solution. Some results, obtained through processing the equations with an electronic computer, show the correlations between the concerned parameters. Author

N66-21644# Defence Research Telecommunications Establishment, Ottawa (Ontario).

ALOUETTE I TIME CHARTS, SEPTEMBER 1962–DECEMBER 1963

1 Nov. 1965 209 p

CFSTI: HC $6.00/MF $1.25

Alouette I time charts are presented to provide a graphical indication of the duration of the Alouette operations which include four primary experiments, housekeeping operations, or combinations of these. The four experiments are the topside counter, particle counter, VLF receiver, and the cosmic noise receiver. R.N.A.

N66-21661*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

SPACE PROGRAM SUMMARY NO. 37-36, VOLUME VI FOR THE PERIOD SEPTEMBER 1, 1965 TO OCTOBER 31, 1965. SPACE EXPLORATION PROGRAMS AND SPACE SCIENCES

30 Nov. 1965 41 p

(Contract NAS7-100)

(NASA-CR-71402; JPL-SPS-37-36, Vol. VI) CFSTI: HC $2.00/MF $0.50 CSCL 22D

Lunar and planetary-interplanetary programs, the Deep Space Network, supporting activities, and space instruments are discussed in a summary of current projects. Flight control, electronics, electrical power supply, propulsion, and systems testing are reviewed for the Surveyor project. Mariner IV space flight operations and power subsystem performance are considered, progress on the Voyager project is reported, and a project is proposed for a systems comparison of direct and relay link communications for an eventual long-life Mars surface experiment. Consideration is also given to various operations and test activities related to the Deep Space Instrumentation Facility, a 120-port multiple pressure measuring system, and tests of the Mariner C television shutter solenoid in a space molecular sink simulator. M.W.R.

N66-21700*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md.

FLIGHT REPORT—INTERPLANETARY MONITORING PLATFORM—IMP-I—EXPLORER XVIII

Frank A. Carr Washington, NASA, Apr. 1966 31 p refs

(NASA-TN-D-3352) CFSTI: HC $0.45/MF $0.50 CSCL 22B

Following a successful launch, IMP-I operated successfully for six months. Thereafter performance levels decreased and only limited data was provided during the next 12 months. A total of nearly 6000 hours of data were obtained. The elliptical orbit of IMP-I, reaching 106,000 nautical miles into cislunar space, provided the 9 scientific experiments with a unique opportunity to examine the outer limits of the Earth's magnetosphere, the transition region, and interplanetary space. The performance of the spacecraft systems—telemetry, power, and thermal—was near nominal and is discussed based on telemetered performance parameter data. Some possible reasons for the degradation of the silver cadmium battery, which resulted in reduced operation, are discussed. Author

N66-21703*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md.

IMP-I SPACECRAFT MAGNETIC TEST PROGRAM

C. L. Parsons and C. A. Harris Washington, NASA, Apr. 1966 86 p refs

(NASA-TN-D-3376) CFSTI: HC $1.35/MF $0.75 CSCL 22B

The magnetic tests of the IMP-I spacecraft (Explorer XVIII) include both individual component and integrated spacecraft test results. By having incorporated component testing in the early stages of the program, it was possible to obtain the following information: (1) individual component magnetic field disturbance magnitudes, (2) possible spacecraft field contribution due to assembled components, (3) to determine which components have excessive magnetic field, (4) a means by which excessive field could be reduced, and (5) possible results due to perming and deperming effects. Based upon the magnetic test results and upon the telemetered in-flight data, the design goal (magnetic) for the IMP-I was achieved. Author

N66-21704*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SYNCOM III LAUNCH
Forest H. Wainscott Washington, NASA, Apr. 1966 14 p
(NASA-TN-D-3377) CFSTI: HC $0.20/MF $0.50 CSCL 22B

The Syncom III spacecraft was launched from Cape Kennedy, Florida on 19 August 1964 with the three stage thrust-augmented Delta vehicle configuration using the ABL X-258 solid propellant motor as the third stage. Through appropriate adjustment of the Delta powered flight, the transfer orbit, and the apogee motor boost direction, a synchronous orbit with a final inclination near zero degrees was achieved. Subsequent maneuvering with the satellite's on-board hydrogen peroxide jet control system reduced the orbital eccentricity to zero and located the spacecraft over the International Date Line. Author

N66-21829# Institute of Naval Studies, Cambridge, Mass.
CHANNEL CAPACITIES OF MULTIPLE/RANDOM ACCESS COMMUNICATIONS SATELLITE REPEATERS
David B. Newman May 1965 30 p refs
(Contract Nonr-3732(00))
(INS-RC-14; AD-627452) CFSTI: HC $2.00/MF $0.50

The channel capacity of a communication satellite repeater is of direct interest to all users in assessing how much service they may expect to obtain from a particular satellite or system. This is especially so when one considers that many users may attempt to gain access to a communication satellite simultaneously and without prior notice—the multiple and random access problem. The purpose of this paper is to present a method for estimating the channel capacities of various generic types of communication satellites which may be considered as alternates for successive generations of development. Author (TAB)

N66-22201*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE LUNAR ORBITER PROJECT SELENODESY EXPERIMENT
William H. Michael, Jr. and Robert H. Tolson [1965] 27 p refs Presented at the 2d Intern. Symp. on the use of Artificial Satellites for Geodesy, Athens, 27 Apr.–1 May, 1965
(NASA-TM-X-56513) CFSTI: HC $2.00/MF $0.50 CSCL 22B

A description of the Lunar Orbiter mission is given, and a profile is provided which covers the mission from launch to final moon orbit. It is stated that the main purpose of the selenodesy experiment is to determine the coefficients in the expansion of the lunar gravitational potential in terms of spherical harmonics. Two methods are presented for determining these coefficients. In the first method the observations are related directly to the gravitational parameters through the integrals of the equations of motion of the spacecraft. The second method employs a reduction of the observations over nonoverlapping time arcs to determine a set of mean elements and the covariance matrix of the mean elements. These methods are discussed in detail and graphs and charts with supporting data are included. H.S.W.

N66-22208*# Goodyear Aerospace Corp., Akron, Ohio.
RADAR REFLECTIVITY DATA ON A LENTICULAR PASSIVE COMMUNICATION SATELLITE Data Report, Apr.–Jul. 1965
Sep. 1965 819 p refs
(Contract NAS1-3114)
(NASA-CR-66050; GER-12331) CFSTI: HC $11.19/MF $4.00 CSCL 22B

Graphic test patterns of monostatic and bistatic radar reflectivity tests conducted on five-ft diameter models of a gravity-gradient stabilized lenticular passive communications satellite are reported. Rf tests are also reported for several representative material and gore seam configurations. All test patterns are placed in numerical order. The vertical seam position is pinpointed on some of the test patterns for reference. In addition, radar cross section plots of various models are compared. Tables listing the test conditions investigated, are given. L.S.

N66-22223*# Boeing Co., Seattle, Wash. Aero-space Div.
SOLID-BOOSTED NOVA VEHICLE STUDY. VOLUME III: CURRENT-TECHNOLOGY VEHICLE Final Report
Apr. 1963 380 p refs
(Contract NAS8-2438)
(NASA-CR-50591; D2-22431, Vol. III) CFSTI: HC $7.00/MF $2.00 CSCL 22D

The structures and weights, environment and control, design configuration, and payload growth of the Current Technology Vehicle (T-65) are considered in this study of a solid-boosted Nova vehicle system. Second-stage trade studies were performed for various bulkhead shapes and three tankage concepts—clustered, multicell, and single tank. Stress analyses were made of the second stage, interstage, cluster structure, and support structure. Insulation requirements and allowable stresses were established, and vehicle loads and aerodynamic heating were predicted. The results of weights analysis of the final configuration, consisting of payload LO_2/LH_2 second-stage, and solid-propellant first stage, are presented. The growth potential of the T-65D vehicle, without changing the number or diameter of first- or second-stage motors, is calculated to be equivalent to a 25.3% increase in payload. M.P.G.

N66-22240*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NASA LANGLEY SMALL METEOROLOGICAL SOUNDING ROCKET DEVELOPMENT PROGRAM
Harold B. Tolefson [1965] 38 p Presented at Indian Natl. Comm. for Space Res. Seminar on Sounding Rocket Tech. and Expt., Thumba, India, 11 Jan. 1965
(NASA-TM-X-56686) CFSTI: HC $2.00/MF $0.50 CSCL 22B

A program has been initiated at the NASA Langley Research Center to develop a small meteorological rocket system for atmospheric measurements in the altitude range from 30 km upwards to 70 km and possibly to 100 km. The objective is to provide a relatively inexpensive system for measuring the basic meteorological parameters of wind, temperature, density, and pressure with an overall reliability of 90 percent. Little or no restriction as to launch location or weather conditions and with direct short-time data availability are included. The paper discusses the work in progress and the achievements made to date. Future plans and the anticipated system progression are outlined. Author

N66-22331* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LAUNCH VEHICLE NOSE SHROUD OPTIMIZATION
E. S. Hendrix (Lockheed Missiles and Space Co., Huntsville, Ala.) and D. L. Bacchus *In its* Aero-Astrodyn. Res. Rev. No. 3 15 Oct. 1965 p 12–16 refs (See N66-22329 11-34)
CFSTI: HC $4.00/MF $1.00
(Contract NAS8-11148)

The effect of nose fairing shape on vehicle performance has been studied for two-stage and three-stage Saturn V type vehicles. Shroud shapes considered were single and double angle cones with and without cylindrical extensions. Other factors that influence shroud weight and vehicle performance were also investigated. The more important variables were found to be the shroud shape, time of jettisoning, required volume, choice of material, and type of construction. The trends found are generally applicable for any vertically launched space vehicle, having a thrust-to-weight ratio at lift-off of approximately 1.25. Author

N66-22379*# Goodyear Aerospace Corp., Akron, Ohio.
FEASIBILITY STUDY AND PRELIMINARY DESIGN OF GRAVITY-GRADIENT-STABILIZED LENTICULAR TEST SATELLITE Interim Technical Report, Jul. 1963–Mar. 1964
1 Jun. 1964 750 p refs
(Contract NAS1-3114)
(NASA-CR-66053; GER-11502) CFSTI: HC $10.49/MF $3.50 CSCL 22B

The feasibility of a gravity–gradient stabilized, lenticular satellite for passive communications was established. Studies were based upon a lenticular reflector, having a 200 foot radius of curvature, which would provide horizon to horizon communications coverage at an orbital altitude of 2000 nautical miles. Key elements of the study, conducted in four phases, consisted of satellite stabilization, damping systems, orientation, microwave reflectivity, structural analyses, and the development of materials, packaging, and deployment concepts. Component and model tests were conducted to verify deployment concepts, microwave reflectivity theories, material photolyzation rates, and material and structural tests which did not require a zero gravity environment. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N66-21109# Lowell Technological Inst. Research Foundation, Mass.
EFFECTS OF EXTERNAL FORCES (TRANSIENT AND PERMANENT) Second Quarterly Report, 1 Aug.–31 Oct. 1965
Charles R. Mingins, Robert W. Perry, and Luther C. Barcus [1965] 47 p refs
(Contract DA 28-043-AMC-01240(E))
(Rept. 18; AD-627711) CFSTI: HC $2.00/MF $0.50

In further research on the reactions of an excited piezoelectric crystal plate to the application of external forces and torques, a more extended study has been made of superimposed force fields set up in AT-cut piezoids. New instances here reported upon with respect to both single and superimposed force arrangements include: (a) rectangular plates with edges rotated in the XZ' plane, (b) larger plates than those previously used, and (c) combinations of tensile and compressive forces applied simultaneously. Results obtained with shearing stresses, some of them quite large, in rectangular and circular plates are reported. Experiments carried out in the application of transient forces to oscillating crystals are discussed. Nonlinear theory is applied to the complete range of X-rotated cuts and the results are assayed by the degree of fit between experimental and theoretical curves.
Author (TAI

N66-21153# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).
BENDING OF ORTHOTROPIC PLATES UNDER UNIFORM TRANSVERSE LOADING, AND THE ANALOGY WITH BEAMS ON AN ELASTIC LAYER
F. J. Plantema and P. J. Sevenhuysen Apr. 1965 32 p refs presented at the 6th European Aeron. Congr., Munich, Sep. 1965 Submitted for Publication
(MP-234) CFSTI: HC $2.00/MF $0.50

A few peculiar phenomena arising when orthotropic plates and beams supported by an elastic layer are bent under the action of a uniform transverse load are discussed. The deflection surface of the plate and the deflection curve of the beam may exhibit the same unexpected features, which are apparently little known. A physical explanation of these phenomena is given. A perfect analogy is shown to exist between the deflection patterns of a plate with zero torsional stiffness and a beam on an elastic layer. Author

N66-21155# General Motors Corp., Indianapolis, Ind. Materials Labs.
METALLURGICAL FAILURE ANALYSIS OF Ti-6Al-4V ALLOY LEM PROPELLANT TANK, P/N 6848367, S/N P-8
U. L. Hellmann 19 Apr. 1965 19 p
(Rept.-65-FA8-6)

A Ti-6Al-4V alloy LEM propellant tank failed prematurely at 267 psig during hydrotest, approximately 74% of proof pressure. Failure initiated in the upper dome component and was due to an embrittled massive alpha structure that was encapsulated in the forging. This investigation was conducted to determine the nature and cause of failure and to obtain mechanical properties of the subject propellant tank. Author

N66-21174# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
SURVEY OF LITERATURE ON BUILDINGS FOR THE ARMED SERVICES [LITERATUUROVERZICHT KRIJGS BOUWKUNDE]

4 Mar. 1966 23 p refs In DUTCH and ENGLISH *Its* Vol. 8, No. K-82
CFSTI: HC $1.00/MF $0.50

Contains abstracts and bibliographic notes on general applied mechanics, cement, health techniques and clean rooms, civilian construction, atomic-biologic-chemical warfare, and technical news. Transl. by J.O.

N66-21213# Naval Ordnance Lab., White Oak, Md. Underwater Explosions Div.
THE RESISTANCE OF HOLLOW GLASS MODELS TO UNDERWATER EXPLOSIONS AT GREAT DEPTHS. I: SPHERES
W. H. Faux and C. R. Niffenegger 30 Sep. 1965 28 p refs (NOLTR-65-145; AD-623650) CFSTI: HC $2.00/MF $0.50

Hollow glass spheres, 10 in. in diameter, were exposed to explosions of 1-lb charges at a series of depths in the ocean. At a depth of 300 ft, a sphere could not be placed closer than 19 ft from the charge without breaking. At 22,000 ft, the sphere could be as close as about 2.5 ft without damage. At this smaller range, the shock wave peak pressure was estimated to be an order of magnitude greater than at 19 ft, indicating a greatly increased strength of the spheres.
Author (TAB)

N66-21225# Atomic Weapons Research Establishment, Aldermaston (England).
COMPARISON OF THE ULTIMATE LOAD CARRYING CAPACITY OF LATERALLY RESTRAINED/UNRESTRAINED, REINFORCED/UNREINFORCED CEMENT MORTAR MODEL BEAMS AND TWO-WAY PANELS
C. F. Millington Jan. 1966 171 p
(AWRE-O-87/65) HMSO: 25s

This report compares the ultimate load carrying capacity of laterally restrained and unrestrained, reinforced and unreinforced cement mortar model beams and panels. The beams and panels used are described, as well as their composition and reinforcement, methods of test, and the resulting data.
M.R.W.

N66-21249# Atomic Weapons Research Establishment, Aldermaston (England).
BLAST LOADING ON A RIGHT CIRCULAR CYLINDER
Valerie C. Martin, K. F. Mead, and J. E. Uppard Nov. 1965 39 p refs
(AWRE-O-93/65) HMSO: 5s

Drag coefficients and vortex characteristics for a restricted range of finite and infinite right circular cylinders under blast loading conditions are estimated. In the first experiment, the cylinder was allowed to be transported in the flow behind the shock front and was observed in flight by a motion picture camera. This gave distance–time graphs, from which the drag coefficients were calculated. In another experiment, the frequency at which the vortices are shed were determined, permitting an estimate of the drag coefficient. It was tentatively concluded that there was good agreement with previous data on drag coefficients from larger wind tunnel experiments and on vortex shedding and uneven vortex formation along the cylinder.
N.E.N.

N66-21261# North Carolina State Coll., Raleigh. Applied Mathematics Research Group.
CONTACT PROBLEMS IN THE LINEAR THEORY OF VISCOELASTICITY
G. A. C. Graham 10 Sep. 1965 47 p refs
(Grant AF-AFOSR-444-64)
(AFOSR-65-1906; AD-626055) CFSTI: HC $2.00/MF $0.50

Some well known elastic half space solutions are generalized to encompass arbitrary linear viscoelastic behavior. The viscoelastic material is assumed to be homogeneous and isotropic, and thermal effects are not included. The main part of the survey is devoted to the quasi-static theory whose distinguishing feature is the neglecting of the inertia terms in the equations of motion. Expressions are found for the displacement stress field acting at any point of a viscoelastic half space whose boundary is subjected to an arbitrary time dependent distribution of normal pressure. The solution to the general axisymmetric elastic contact problem given by Sneddon is extended to viscoelasticity theory. Generalizations of the axisymmetric elastic contact problem with friction and Hertz's theory of the contact of smooth elastic bodies are also given. Problems of rolling contact are considered, and some viscoelastic half space problems are solved on the assumption that inertia terms may not be neglected. Author (TAB)

N66-21301# Andrew Corp., Chicago, Ill.
STRUCTURAL AND COST OPTIMIZATION OF THE MULTIPLATE ANTENNA REFLECTING PANELS Final Report, Sep. 1964–Apr. 1965
Anthony J. Lacopulos Sep. 1965 209 p refs
(Contract AF 19(628)-4319)
(AFCRL-65-790; AD-627322) CFSTI: HC $6.00/MF $1.25

The report presents the results of a research effort dedicated to optimizing the structural design and manufacturing the erection costs of the reflecting panels used in conjunction with the proposed Multiplate Antenna project. The study primarily considers the reflecting panel construction with only limited attention to related pedestals, foundations, actuating components, etc. The report discusses surface contours, allowable tolerances, error contributors and panel sizes. Structural requirements are discussed and methods of solution presented. Results of stress and deflection analyses are given for alternate design concepts. Manufacturing, installation and cost evaluations are used to arrive at final recommendations. The recommended reflecting panel construction consists of a three-dimensional network of tubular members (space frame) supporting a rectangular rib framework. The rib framework in turn supports a welded wire mesh surface. An adjustment feature is built into the proposed construction to create variable surface contours. Section II contains a complete description of the final recommendations. The cost of supplying enough panels to cover 2 million sq. ft. of antenna surface is $2.85 million dollars or less than $1.50 per sq. ft. Author (TAB)

N66-21308# J. G. Engineering Research Associates, Baltimore, Md.
FARFIELD PRESSURE OF RANDOMLY VIBRATING STRUCTURES OVER GIVEN FREQUENCY BANDS
Joshua E. Greenspon Oct. 1965 14 p refs
(Contract Nonr-2733(00) FBM)
(TR-13; AD-626438) CFSTI: HC $1.00/MF $0.50

A relation between the cross spectral density of the farfield pressure outside a surface surrounding a sound surface is given in terms of cross spectral density of the normal acceleration over a surface surrounding the source; the cross spectral density of the acceleration is given in terms of the modes of the structure. A resulting multipole expansion for the mean square farfield pressure in low frequency bands is

derived using a free field Green's Function. An expression for the magnitude and directivity of the farfield mean square pressure from various types of motions in any frequency band is obtained. Author (TAB)

N66-21311# Naval Ordnance Lab., White Oak, Md.
RESIDUAL BORE STRESS IN AN AUTOFRETTAGED CYLINDER CONSTRUCTED OF A STRAIN HARDENING MATERIAL
Victor C. D. Dawson Feb. 1966 20 p refs
(NOLTR-64-25; Ballistics Res. Rept.-126; AD-626927) CFSTI: HC $1,00/MF $0.50

The calculation of the residual bore stresses in an autofrettaged cylinder is based upon a theory utilizing a perfectly plastic material. Nadai suggested a technique which would account for strain hardening of the material. The present report compares experimentally measured data for an autofrettaged cylinder, constructed of a strain hardening material, with this theory. Author (TAB)

N66-21321# Naval Ordnance Lab., White Oak, Md.
STRESS WAVE PROPAGATION IN A STRAIN RATE SENSITIVE MATERIAL
James L. Rand, Jackson C. S. Yang, and John M. Marshall Jan. 1966 32 p refs
(NOLTR-65-11; Ballistics Res. Rept.-143; AD-626634) CFSTI: HC $2.00/MF $0.50

The purpose of this study is to examine the existing theories for material response, utilizing the dynamic stress-strain properties of 'rate sensitive' materials. All the predictions made from the theories were verified experimentally. An air gun was used to impact small Lexan cylinders against a high strength target. The deformation, as well as the propagation of the stress wave resulting from the impact, were measured and are within 8.5% of the predicted results. Author (TAB)

N66-21328# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.
SOME ASPECTS OF THE ANALYSIS OF DAMPING AND VIBRATIONS IN SIMPLE STRUCTURES Summary Report, Oct.–Apr. 1965
D. I. G. Jones Dec. 1965 255 p refs
(AFML-TR-65-151; AD-628279) CFSTI: HC $6.00/MF $1.25

While no particular claim to completeness is made, this monograph represents an attempt to summarize, within one volume, the various structural damping techniques that have been developed in recent years. Included, for example, are discussions of unconstrained layer treatments, sandwich panels, viscoelastic tuned dampers and a new corrugated treatment. Certain fundamentals of the theory of vibration in general, necessary to complete understanding of the subject of damping, are included in appendices. Author (TAB)

N66-21342# Mississippi State Univ., State College. Dept. of Aerophysics.
A PRELIMINARY STUDY TO DETERMINE THE FEASIBILITY OF REINFORCED PLASTIC COLUMN MEMBERS FOR AIRCRAFT STRUCTURES Research Report No. 60
Dev R. Bhandari Dec. 1965 75 p refs
(Contract DA-44-177-AMC-892(T))
(USAAVLABS-TR-65-76; AD-628675) CFSTI: HC $7.60/MF $0.75

Empirical formulas for predicting the critical buckling stress of fiber glass reinforced plastic columns have been obtained. On the basis of these buckling formulas, structural efficiency of fiber glass reinforced plastic column members of different cross sections is compared with other commonly used structural alloys. The efficiency parameter used for comparison is derived on the minimum weight design considerations. Author (TAB)

N66-21371# New Mexico Univ., Albuquerque.
PRODUCTION AND MEASUREMENT OF A DILATATION LOADING FIELD
F. D. Ju and R. A. Benham Sep. 1965 109 p refs
(Grant AF-AFOSR-568-65)
(AFOSR-65-2676; ME-17; AD-628790) CFSTI: HC $4.00/MF $0.75

A model of homogeneous, isotropic material was developed in which pure dilatation could be produced and measured. Essentially, the model is a cube of resin epoxy each face of which is pulled by equal tensile force. The equal tensile forces were produced with a hydraulic triaxial tensile testing machine developed for this project. The states of strain were then measured and recorded. An embedded three-dimensional strain gage rosette was used. Dilatation states were produced to within instrumentation error at a hydraulic pressure of 10 psig and carried through to the maximum level of 60 psig which induced an internal strain of approximately 400 μ in/in. The instrumentation error is estimated to have an accumulative maximum of ±9%. There was also an evaluation of the perturbative effects due to the loading device. Included were alignment perturbation causing additional bending moment in the model and excessive friction in the load cylinder causing unequalization of the triaxial loads. Author (TAB)

N66-21401# Catholic Univ. of America, Washington, D. C.
STRESSES IN SQUARE SLABS, WITH DIFFERENT EDGE GEOMETRIES, WHEN BONDED ON ONE FACE TO A RIGID PLATE AND SHRUNK Progress Report
H. J. Durelli, V. J. Parks, and C. J. del Rio Dec. 1965 17 p refs
(Contract AF 04(611)-10378)
(PR-5; AD-625220) CFSTI: HC $1.00/MF $0.50

An approximately square epoxy slab (approx. 14 in × approx. 14 in × 1 in) with four different edge geometries was bonded to a rigid plate on one of its faces. In the process of 'freezing' photoelastic effects a state of restrained shrinkage developed. Slices removed from the slab were used to determine the concentration factors corresponding to the four geometries. Author (TAB)

N66-21420# Ohio River Div. Labs., Mariemont.
RESPONSE OF FIBROUS-REINFORCED CONCRETE TO EXPLOSIVE LOADING
G. R. Williamson Jan. 1966 79 p refs
(TR-2-48; AD-627889) CFSTI: HC $3.00/MF $0.75

The results of 72 explosive loading tests on fibrous-reinforced concrete slabs are presented. The slabs, 32×32×4 inches, were tested in a vertical position with 4 inches of bearing on the two vertical sides. A 10-pound cylindrical charge of Composition B high explosive was used as the loading mechanism. Various synthetic and steel fibres were used as random reinforcing to develop a concrete that would resist explosive loadings. Evaluation was based upon the ability of the fibrous concrete to reduce the amount and velocity of fragments produced by the explosive loading. The values obtained from tests of plain, unreinforced concrete slabs were used as the basis of comparison. It is shown that

when plain concrete slabs are reinforced conventionally to resist the shear and flexural stresses, there is no reduction in fragment velocities or fragmentation; and, that similarly reinforced slabs of fibrous concrete show 20% reduction in velocities, and over 80% reduction in fragmentation. A study made to evaluate high-strength and medium-strength concrete, when used in conjunction with fibres, revealed no significant difference in response under the explosive loading. The mode of failure for a slab supported on two sides only is shown to be primarily flexural. Detailed descriptions of each individual test are presented, together with conclusions and recommendations for future work. Author (TAB)

N66-21424# Ballistic Research Labs., Aberdeen Proving Ground, Md.

A FAILURE CRITERION FOR BLAST LOADED CYLINDRICAL SHELLS

William J. Schuman, Jr. May 1965 117 p refs (BRL-R-1292; AD-628289) CFSTI: HC $11.60/MF $0.75

The results of an extensive experimental program to study the plastic response of thin-walled, unstiffened cylindrical shells to external blast loading are presented. Empirical relations between the shell and blast parameters that satisfy a failure criterion based on a given level of plastic deformation are given. A comparison of calculated and actual overpressure values for 159 shells that had responses satisfying the failure criterion (permanent deformation in the radial direction—5 percent to 10 percent of the original diameter) is made. The average deviation between these values is 14 percent. Author (TAB)

N66-21477# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.

DEFORMATION AND FAILURE ANALYSIS OF REINFORCED GRAIN

A. M. Freudenthal Jun. 1965 60 p refs Presented at the Intern. Conf. on the Mech. and Chem. of Solid Propellants (4th Symp. on Naval Structural Mech.), Purdue Univ., Lafayette, Ind., 19–21 Apr. 1965

(Contract Nonr-266(78))

(TR-28; AD-627641) CFSTI: HC $3.00/MF $0.75

After considering the limitations imposed by the characteristic response of filled elastomers on the performance of case-bonded solid propellant grains, particularly the effect of loss of filler-binder interaction with increasing strain, the significant features of metal-wire of mesh-reinforced grains are discussed. The difference between the design criteria for such grains and for other types of reinforced structures is emphasized and the inapplicability of classical methods of visco-elastic analysis is discussed. Methods of analysis of elastic orthotropic, inhomogeneous, case bonded grains are summarized and their limitations show with respect to optimal utilization of the reinforcement. Such utilization requires thickness of the grain and the consideration of its elastic-plastic response in grain analysis. Author (TAB)

N66-21639*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

NACA CONFERENCE ON AIRCRAFT LOADS, FLUTTER, AND STRUCTURES Compilation of Papers

[1953] 575 p refs Conf. held at NASA, Langley Research Center, 2–4 Mar. 1953

(NASA-TM-X-57364) CFSTI: HC $8.75/MF $2.75 CSCL 01C (Declassified)

This document contains technical papers presented at a conference on aircraft loads, flutter, and structures. The papers are concerned with factors influencing maximum loads; load distribution on lifting surfaces; loads on bodies, interference effects, and external stores; loads associated with controls; tail loads; a technique for flight loads measurements; gust loads; flutter and buffeting; landing loads in crash landings; fatigue; structural heating; stresses and deflection; strength; and dynamics. R.N.A.

N66-21667 International Business Machines Corp., San Jose, Calif. Research Lab.

EQUATIONS OF MOTION FOR ELASTIC BODIES ENTERING A PLANETARY ATMOSPHERE

P. K. C. Wang and N. E. Langlois *In its* Papers on the Control of Distributed Parameter Aeroelastic Systems Nov. 1965 p 5–28 refs (See N66-21666 11-01) CFSTI: HC $5.00/MF $1.00

The equations governing the motion of elastic bodies during their entry into a planetary atmosphere at hypersonic velocities were derived under reasonable physical assumptions. The results are applied to the derivation of a mathematical model for a simplified flexible aerodynamic re-entry vehicle. Author

N66-21668 International Business Machines Corp., San Jose, Calif. Research Lab.

APPLICATION OF LYAPUNOV'S DIRECT METHOD TO STABILITY PROBLEMS IN ELASTIC AND AEROELASTIC SYSTEMS

P. K. C. Wang *In its* Papers on the Control of Distributed Parameter Aeroelastic Systems Nov. 1965 p 29–64 refs (See N66-21666 11-01) CFSTI: HC $5.00/MF $1.00

This section discusses the formulation of stability problems in both elastic and aeroelastic systems in the framework of Lyapunov stability theory. The applicability of Lyapunov's direct method to these problems is further explored along the direction set forth by Movchan and Slobodkin. A number of specific examples are worked out in detail so as to reveal some of the difficulties and to give some idea on the class of problems for which Lyapunov's direct method is readily applicable. Author

N66-21669 International Business Machines Corp., San Jose, Calif. Research Lab.

ASYMPTOTIC STABILITY OF EQUILIBRIUM OF A SIMPLIFIED AERODYNAMIC VEHICLE WITH FLEXIBLE TAIL

P. K. C. Wang *In its* Papers on the Control of Distributed Parameter Aeroelastic Systems Nov. 1965 p 65–71 refs (See N66-21666 11-01) CFSTI: HC $5.00/MF $1.00

In a previous paper, sufficient conditions for the asymptotic stability of equilibrium of certain classes of aeroelastic systems with distributed aerodynamic load were derived via Lyapunov's direct method. In this report, similar conditions for a simplified aerodynamic vehicle with flexible tail are derived using the same approach. The mathematical form of this aeroelastic system differs from those considered previously in the sense that the aerodynamic load can be approximated by a concentrated force applied at the domain boundary. In the previously considered systems, the aerodynamic load was spatially distributed and could be approximated by introducing appropriate terms in the system equations. Author

N66-21670 International Business Machines Corp., San Jose, Calif. Research Lab.

STABILITY ANALYSIS OF A SIMPLIFIED PITCH-CONTROLLED FLEXIBLE AERODYNAMIC VEHICLE VIA LYAPUNOV'S DIRECT METHOD

P. K. C. Wang *In its* Papers on the Control of Distributed Parameter Aeroelastic Systems Nov. 1965 p 72–83 refs (See N66-12666 11-01) CFSTI: HC $5.00/MF $1.00

Lyapunov's direct method is used to derive a sufficient condition for asymptotic stability of equilibrium of a simplified flexible vehicle with a pitch autopilot. The basic mathematical model corresponds to that of a non-uniform cantilever beam in plane bending along with a rigid body rotation. It is assumed that the autopilot is composed of a simple proportional plus rate controller. The analytical method used here has the advantage of dealing directly with the system's partial differential equations without resorting to approximations. Author

N66-21685# Lockheed Missiles and Space Co., Sunnyvale, Calif.

BEHAVIOR OF ELASTIC CYLINDRICAL SHELLS UNDER THE EFFECT OF A PLANE ACOUSTIC WAVE

A. S. Vol'mir and M. S. Gershtein [1965] 8 p refs Transl. into ENGLISH from Inzh. Zh. (USSR), v. 5, no. 6, 1965 p 1127–1130

An elastic circular cylindrical infinite shell submerged in a fluid under the effect of a plasma acoustic shock is considered. The wave front is parallel to the shell axis. The shell buckling mode under such loading is investigated taking account of the inertial forces in the middle surface. Expressions, equations, and results are given for the numerical computations of the effect on a shell of a wave behind whose front the pressure is constant and equal to p_0. Curves of the shell deflections and the diagrams of the nondimensional annular stresses $\sigma = N(1-\nu^2)R/Eh^2$ at successive times γ are presented. Here the nondimensional time is $\gamma = ct/R$. The number and location of the dents turned out to be dependent on the intensity of the pressure in the wave and on the relative thickness of the shell. M.R.W.

N66-21696*# North American Aviation, Inc., Columbus, Ohio.

INVESTIGATION OF THE SONIC FATIGUE CHARACTERISTICS OF RANDOMLY EXCITED ALUMINUM VISCOELASTIC PANELS AT AMBIENT TEMPERATURES

B. J. Moskal Washington, NASA, Apr. 1966 44 p refs (Contract NAS1-4728)

(NASA-CR-425) CFSTI: HC $0.66/MF $0.50 CSCL 20K

An experimental sonic fatigue program was conducted on aluminum viscoelastic and aluminum control panels. The panels were tested at 154 db, 157 db, and 160 db using a broad-band siren as the noise source. Previously, these structures were evaluated under discrete frequency excitation. The primary purpose of this effort was to continue to investigate the usefulness of viscoelastic structures under high acoustic random loads. Tests substantiate that the viscoelastic panel has slightly better sonic fatigue properties than an equivalent-by-weight aluminum panel. Author

N66-21768*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

EXPERIMENTAL DAMPING STUDIES Monthly Progress Report, 6 Jul.–5 Aug. 1965

20 Aug. 1965 26 p

(Contract NAS8-20088)

(NASA-CR-71628; LMSC/HREC-A711769) CFSTI: HC $2.00/MF $0.50 CSCL 20K

Testing of the booster empty model configuration was completed during the performance period by obtaining decay records and force frequency relationships for five vibratory modes. The model booster was then ballasted to simulate the weight at maximum dynamic pressure (booster 48% full). Frequency response curves were obtained at six accelerometer locations with the shaker mounted at model stations 24 and 345. Three primary bending modes were identified, their deflection shapes were measured, and decay records were obtained at 1, 1.4, 2, 5, 10, 15, and 20 lb force levels. Some difficulties were encountered in the theoretical analyses of the model vibrations. The basic problem seemed to be the mathematical representation of the upper and lower connections of the center LOX tank and the rest of the structure. Corrective procedures for this problem are being initiated. Author

N66-21783*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

THE EFFECTS OF SATURN VEHICLE LAUNCH NOISE ON PERSONNEL AND WINDOW GLASS

Charles H. Sinex 16 Nov. 1964 32 p refs

(NASA-TM-X-57329; TR-99-1) CFSTI: HC $2.00/MF $0.50 CSCL 22D

An initial appraisal of launch vehicle noise hazards to building structures and personnel led to the application of the present 120 dB maximum allowable sound level at the boundaries of Cape Kennedy Air Force Station (CCAFS) and the Merritt Island Launch Area (MILA). Since this level may restrict future launch operations, a detailed study was conducted to determine the maximum permissible safe sound level at the boundaries of both CKAFS and MILA. Test structures containing commercial type glass windows and stucco casing were not damaged when subjected to 144 dB sound levels during SA-4, SA-5, and SA-6 launches. Unprotected personnel exposed to 123 dB sound levels during the SA-2 launch reported no appreciable unpleasantness or annoyance. All tests proved that the maximum sound level can be safely increased to 130 dB without endangering personnel or residential or commercial structures. Author

N66-21817*# Northrop Space Labs., Huntsville, Ala. Research and Analysis Section.

FORTRAN IV COMPUTER PROGRAM FOR THE EVALUATION OF NATURAL FREQUENCIES AND UNSTABLE VALUES OF THE THRUST FREQUENCY FOR A CIRCULAR CYLINDRICAL SHELL SUBJECTED TO A GIMBALED PERIODICALLY-VARYING END THRUST

C. M. Pearson and A. D. Merville 23 Aug. 1965 115 p refs *In its* Tech. Memo No. 100

(Contract NAS8-11255)

(NASA-CR-71537; E20-114) CFSTI: HC $4.00/MF $0.75 CSCL 20K

This report presents a Fortran IV computer program that evaluates the natural frequencies of a thin cylindrical shell with simply supported edge conditions. It also evaluates unstable values of the thrust frequency for given input conditions. Stability considerations are included to facilitate an understanding of the equations that are solved by the program (main program and subroutines). The program is operationally compatible with the Fortran processors of the IBM 7094 and the Univac 1107 digital computers. An appendix gives information on the solution of the stability equations and mathematical details on the method of iteration used in the program. CT

N66-21838# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Mechanical Engineering.
VIBRATIONS OF TWO-LAYERED PLATES Scientific Report No. 5
Nann Ren and Yi-Yuan Yu Jun. 1965 28 p refs
(Contract AF 49(638)-1290)
(AFOSR-65-1423; AD-627962) CFSTI: HC $2.00/MF $0.50

Four approximate theories of two-layered plates have been presented. Among these the two uncoupled classical theories of flexure and extension are the simplest. For the finite plate the flexural theory gives the flexural branch and the extensional theory the equivoluminal and extensional branches of the frequency spectrum. The three branches all start from the origin and are in an ascending order as just stated. The classical theory that includes the effect of coupling between flexure and extension produces the same three branches of the frequency spectrum, in fact with little improvement over the uncoupled theories up to, say, 20,000 cps. The important thing to note, however, is that flexure and extension are in general coupled. Therefore, either type of excitation will induce both types of motion simultaneously, which can only be accounted for by the coupled theory.
TAB

N66-21852# Naval Research Lab., Washington, D. C.
TENSILE STRESSES ON THE SURFACE OF AN ELLIPSOIDAL CAVITY IN COMPRESSIVE LOADING SITUATIONS
D. R. Mulville and J. A. Kies 12 Mar. 1965 18 p refs
(NRL-6210; AD-613552) CFSTI: HC $1.00/MF $0.50

The stresses on the walls of embedded cavities have been investigated, particularly for compressive loading situations corresponding to those for shells for deep submergence. The discrepancy between theoretical and measured compressive strength of brittle solids is one motivating factor for extending this investigation. The maximum tensile stress components are equal numerically to the applied compressive stress. The maximum tensile stresses depend on the shape of the cavity, Poisson's ratio, and the orientation of the cavity in the shell. It is recommended that the work continue with the aim of showing the effects of cavities on strength. One approach recommended is to calculate the effects of cracks in the walls of the cavities.
Author (TAB)

N66-21915# Naval Ordnance Lab., White Oak, Md.
AN INVESTIGATION OF THE DYNAMIC DEFORMATION OF SMALL COPPER BALLS
Houston M. Cole 27 Dec. 1965 61 p refs
(NOLTR-65-189; AD-627652) CFSTI: HC $3.00/MF $0.75

Annealed copper balls of the type used in tarage and crusher gages were compressed at compression speeds from 0.01 in/min to about 400 ft/sec. It was found that the force-deformation curve at any two velocities of compression are related as the ratio of the mean velocities of compression. The force-deformation curve roughly follows that of a spring-mass system; however, a more accurate method is described which gives pressures from large explosions which are much closer to actual piezoelectric gage measurements than found by previous calculations.
Author (TAB)

N66-22172*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BUCKLING OF SEGMENTS OF TOROIDAL SHELLS
Manuel Stein and John A. Mc Elman [1965] 25 p refs Presented at the AIAA Aerospace Sci. Meeting, New York, 25-27 Jan. 1965
(NASA-TM-X-54995) CFSTI: HC $1.00/MF $0.50 CSCL 20K

Nonlinear differential equations of equilibrium and buckling equations are derived for segments of toroidal shells near the equator and for segments near the crown. The equations are derived for shallow shell segments by including appropriate prescribed initial displacements in the nonlinear, flat plate, strain-displacement equations and by varying the total potential energy of the system. Closed form solutions to the buckling equations are obtained for simply supported segments near the equator having either positive or negative Gaussian curvature under pressure loading with various inplane support conditions. Results are presented in the form of charts showing buckling coefficients as a function of a curvature parameter associated with the girth of the shell and a parameter associated with the ratio of principal curvatures. In many instances the results indicate significant deviations in buckling stress for the toroidal shells over the buckling stress for the toroidal shells over the buckling stress for the corresponding circular cylindrical shell under similar loading and support conditions.
Author

N66-22190# Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
EFFECTS OF ECCENTRICITY OF STIFFENERS ON THE GENERAL INSTABILITY OF STIFFENED CYLINDRICAL SHELLS UNDER TORSION Scientific Report No. 3
Menahem Baruch, Josef Singer, and Tanchum Weller Aug. 1965 46 p refs
(Grant AF-EOAR-63-58)
(TAE-43; AD-628174) CFSTI: HC $4.60/MF $0.50

A method of analysis of eccentrically stiffened cylindrical shells, developed earlier, is applied to buckling under torsion. In the calculations about 350 shells covering a wide range of shell and stiffener geometries have been considered. It is found that for long cylinders rings are the important stiffeners, and internal rings stiffen more than external rings. For short cylinders the effect is inverted, external rings yielding higher critical loads than internal rings. Stringers have little effect in long cylinders, but in short cylinders they stiffen the shell against buckling in torsion as much as rings. Outside stringers always stiffen the shell more than inside stringers.
Author

N66-22206*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DYNAMIC ENVIRONMENT OF SPACECRAFT SURFACE TRANSPORTATION
J. W. Schlue 15 Mar. 1966 25 p
(Contract NAS7-100)
(NASA-CR-71771; JPL-TR-32-876) CFSTI: HC $1.00/MF $0.50 CSCL 22B

A discussion of shock and vibration data from measurements on spacecraft while being surface transported, is given. Acceleration amplitude statistics and predominant frequencies of different locations within a typical air ride suspension van are graphically presented. In addition, instrumentation requirements associated with the acquisition of transportation data are discussed.
L.S.

N66-22209*# Harvard Univ., Cambridge, Mass.
DYNAMIC BUCKLING OF ELASTIC STRUCTURES: CRITERIA AND ESTIMATES
Bernard Budiansky Jan. 1966 49 p refs Presented at the Intern. Conf. on Dyn. Stability of Struct., Northwestern Univ., Evanston, Ill., 18-20 Oct. 1965
(Grant NsG-559)
(NASA-CR-66072; SM-7) CFSTI: HC $2.00/MF $0.50 CSCL 20K

The concept of the buckling of an elastic structure subjected to time-dependent loads is examined critically and criteria for dynamic buckling are reviewed and discussed. Attention is restricted to structures that are sensitive to initial imperfections, and hence are prone to catastrophic failures. Generalized estimates are made for the dynamic buckling strengths of such structures subjected to various loading histories. Author

N66-22234*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SCOUT VEHICLE FLIGHT LOADS

Kermit G. Pratt and Harold C. Lester [1965] 21 p refs Presented at the AIAA Structural Dyn. and Aeroelasticity Conf., Boston, 30 Aug.–1 Sep. 1965

(NASA-TM-X-56658) CFSTI: HC $1.00/MF $0.50 CSCL 22D

Flight loads investigations are being conducted with the Scout launch vehicle. Winds, gusts, and control commands and the resulting vehicle motions and structural loads were measured during the first stage burning period of a Scout flight. The control commands and the measured wind and gust profile were used as disturbances in an analytical simulation program to calculate the vehicle motions and loads. A comparison of the measured motions and loads with the calculated responses revealed some discrepancies of unexpected magnitudes. Analyses of the discrepancies to determine the sources are in progress. Initial results are reported herein. The features of the flight tests, the Scout vehicle, the instrumentation, the flight conditions, and the method of calculation are described. Some test and calculated results are presented and discussed with respect to quasi-static and dynamic responses of the vehicle. R.N.A.

N66-22254*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A COMPARISON OF FRACTURE MECHANICS AND NOTCH ANALYSIS

Paul Kuhn [1965] 18 p refs Presented at the Am. Soc. for Testing and Mater., Spec. Comm. on Fracture Testing, Washington, 13 Jan. 1965

(NASA-TM-X-56206) CFSTI: HC $1.00/MF $0.50 CSCL 20K

This paper presents a general comparison of fracture mechanics and notch analysis with respect to fundamentals and to scope. This is followed by a more detailed comparison using test results. The study showed a notable difference in scope for the two methods. The variation of the notch toughness constant K_c with specimen dimensions was serious, since this variation amounts to a factor of about three precisely for those aluminum alloys which are in greatest need of having their notch toughness well defined and controlled. Since the variation is due to the use of the Griffith proposition, a reappraisal of this proposition appears to be in order for any material which is expected to develop more than about one-tenth of its tensile strength. R.N.A.

N66-22259*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DEVELOPMENT OF AN EXPANDABLE AIRLOCK UTILIZING THE ELASTIC RECOVERY PRINCIPLE

Jerry G. Williams [1965] 32 p refs Presented at the Aerospace Expandable Struct. Conf., Minneapolis, 25–27 May, 1965

(NASA-TM-X-56354) CFSTI: HC $2.00/MF $0.50 CSCL 22B

An airlock is a pressure vessel which facilitates the passage of men or materials between regions of differential pressure. In this paper a review is made of expandable airlock concepts for use in the space environment. The design of an expandable airlock which utilizes the stored potential energy of a compressed foam for deployment is described in detail. Specific topics covered are those of structural design, micrometeoroid penetration resistance, thermal control, and packaging techniques. Author

N66-22262*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DESIGN CRITERIA FOR INFLATED, EXPANDABLE BEAMS USED AS STRUCTURAL MEMBERS IN AN ADVANCED CONCEPT PARAGLIDER

Royce A. Toni and James F. Mc Nulty [1965] 20 p refs Presented at the 2nd Aerospace Expandable Struct. Conf., Minneapolis, 25–27 May, 1965

(NASA-TM-X-56353) CFSTI: HC $1.00/MF $0.50 CSCL 22

The paper describes an analytical method to be used in designing the structural frame of an advanced concept paraglider to assure that the frame retains its structural integrity under the known load conditions. The design of an inflated beam utilized in the structural frame of the paraglider is presented. The interactional effects of shear, bending moment, axial compression or tension, and torque are discussed with respect to sizing the beam and defining both the fabric strength and design inflation pressure. Consideration is given to the influence of biaxial stress conditions and inflative growth on both the design of a beam and its fabrication. Preliminary wind-tunnel tests of models substantiated the design methods developed in this paper. Author

N66-22267*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.

HYPERVELOCITY IMPACT EFFECTS ON LIQUID HYDROGEN TANKS Final Report, 1 Jul. 1964–30 Nov. 1965

C. W. Ferguson [1965] 45 p refs

(Contract NAS3-4193)

(NASA-CR-54852; SM-52027) CFSTI: HC $2.00/MF $0.50 CSCL 20K

An investigation was conducted to determine the structural behavior of cryogenic tank wall materials under simulated meteoroid environments and to develop practical engineering methods defining tank working stresses under the impact of hypervelocity projectiles. The boundary limits between safe fracture and catastrophic fracture were established for aluminum and titanium alloy used in cryogenic propellant tanks. Hypervelocity projectiles of known weight were launched by a light-gas gun to simulate meteoroid impact. Preliminary impact tests were conducted with the tank walls at −320° F and numerous tests were conducted at −423° F. Measurements of shock-wave characteristics of the contained cryogenic propellants were taken and, then, used as an aid in formulating tank design equations. The tank membrane stresses at fracture were related to the material fracture toughness. Fracture toughnesses were determined from hypervelocity preflawed and fatigue cracked panels at −423°F. Good correlations were obtained between the experimental and calculated biaxial toughness which were predicted from uniaxial data. Author

N66-22271*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SUPERSONIC FLUTTER OF SIMPLY SUPPORTED ISOTROPIC SANDWICH PANELS

Larry L. Erickson and Melvin S. Anderson Washington, NASA Apr. 1966 52 p refs

(NASA-TN-D-3171) CFSTI: HC $0.75/MF $0.50 CSCL 20K

A theoretical solution using two-dimensional static aerodynamics is presented for the supersonic flutter characteristics of flat rectangular isotropic sandwich panels with simply supported edges. Tables and charts giving the values of the dynamic-pressure parameter required for flutter are presented for various values of panel length-width ratio, shear flexibility, and midplane stress. It is found that a decrease in transverse shear stiffness will usually lower the dynamic pressure required to induce flutter. However, for certain cases of midplane tension the opposite effect occurs. Panel mode shapes are also presented and a comparison is made of the two-mode Galerkin, the pre-flutter, and the exact flutter solutions. Author

N66-22282*# National Aeronautics and Space Administration, Washington, D. C.
APPLICATION OF PHOTOELASTIC COATINGS IN THE INVESTIGATION OF SHELLS [O PRIMENENII FOTOUPRUGIKH POKRYTIY DLYA ISSLEDOVANIYA OBOLOCHEK]
M. Kh. Akhmetzyanov Jan. 1966 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. (Moscow), no. 6, 1965 p 84–86
(NASA-TT-F-9878) CFSTI: HC $1.00/MF $0.50 CSCL 20K

The article examines stress and resultant membrane and flexural deformation in coatings. Thickness and rotation direction are considered. Author

N66-22321*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ALPS GENERANT TANK AND CELL ASSEMBLY
O. F. Keller and L. R. Toth 28 Feb. 1966 53 p refs
(Contract NAS7-100)
(NASA-CR-71794; JPL-TR-32-865) CFSTI: HC $3.00/MF $0.50 CSCL 22B

The relative advantages of diaphragm-type bladders and balloon-type bladders for expulsion of hydrazine to an advanced liquid propulsion system were investigated. Bladder materials were butyl and ethylene propylene elastomers. Ribs were used to increase expulsion efficiencies at higher pressures. Water expulsion tests were made at pressures up to 100 psig to simulate the flight type generant tank. Two heavy weight steel generant tanks were fabricated for testing as part of a Mariner 1966 prototype subsystem. Expulsion pressures were generally limited to 1300 psig. Three flight type titanium generant tanks were fabricated for testing in a pressurization subsystem. A detailed description of the titanium generant tank fabrication procedure is included. Author

N66-22333* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ON SOME AERODYNAMIC ASPECTS OF THE PANEL FLUTTER PROBLEM
M. Platzer, R. Beranek, and L. Saunders *In its* Aero-Astrodyn. Res. Rev. No. 3 15 Oct. 1965 p 23–32 refs (See N66-22329 11-34) CFSTI: HC $4.00/MF $1.00

Recent panel flutter studies have led to the conclusion that linearized potential flow theory is inadequate to predict panel flutter at low supersonic Mach numbers. Nonlinear transonic flow effects and boundary layer effects were suggested as major reasons for the disagreement between theory and experiment. This paper presents a comparison between linear and nonlinear inviscid supersonic flow past wavy walled planar and cylindrical configurations and discusses their significance toward panel flutter research. Author

N66-22341* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELASTIC STABILITY OF A SLENDER BAR UNDER DYNAMIC LOADS
Frank C. Liu *In its* Aero-Astrodyn. Res. Rev. No. 3 15 Oct. 1965 p 90–94 refs (See N66-22329 11-34) CFSTI: HC $4.00/MF $1.00

This research is concerned with the elastic stability problems of a space rocket under nonconservative, dynamic loads. The mathematical analysis is made on a simple model, a uniform bar with free–free ends with one end subjected to a time-varying thrust load. This work consists of three parts: The first presents the critical thrust of the bar together with an outline of various other buckling criteria under different assumptions; the second shows the elastic stability of a spacecraft due to the coupling of longitudinal and transverse vibrations; and the third part deals with the critical thrust of the bar subjected to high speed aerodynamic load. The variation of frequency of transverse vibration due to the thrust and flight velocity is also illustrated. Author

N66-22342* National Aeronautics and Space Administration Marshall Space Flight Center, Huntsville, Ala.
OPTIMIZATION OF SLOSH BAFFLE GEOMETRY
H. Buchanan *In its* Aero-Astrodyn. Res. Rev. No. 3 15 Oct. 1965 p 95–100 refs (See N66-22329 11-34) CFSTI: HC $4.00/MF $1.00

This paper describes a method for determining the optimum baffle configuration for suppressing excessive propellant sloshing in the tanks of a large launch vehicle. The optimum geometry for a baffle system is considered to be the one with the least mass which is capable of providing the necessary damping. The analysis considers a cylindrical tank and a baffle system made up of several flat ring baffles mounted horizontally. The basic assumptions are discussed and derivations given of the equations necessary to predict the optimum baffle configuration consistent with adequate strength. Numerical results are presented graphically, and some general conclusions are drawn. Author

N66-22362*# McDonnell Aircraft Corp., St. Louis, Mo.
SUMMARY OF THE DIGITAL ADAPTIVE FILTER, DIGITAL POLYNOMIAL FILTER AND SPECIFICATION SET CONTROL TECHNIQUES APPLIED TO LARGE LAUNCH VEHICLES
John Zaborszky and William J. Luedde Washington, NASA, Apr. 1966 34 p refs Summary of rept. B897
(Contract NAS8-11418)
(NASA-CR-462; B897) CFSTI: HC $2.00/MF $0.50 CSCL 22D

The application of digital filter techniques to large launch vehicle control problems was studied through hybrid and digital simulation with a view toward insuring system stability and providing desirable guidance response characteristics. A digital polynomial filter was inserted in the acceleration, i.e., angle of attack, feedback loop in order to minimize the vehicle angle of attack and loads when the vehicle is subjected to wind disturbance inputs. It was concluded that either digitally or linearly filtered acceleration feedback is effective in providing satisfactory launch vehicle performance in the presence of windshear. A digital adaptive filter was applied in the forward loop of the vehicle control system in order to guarantee the ability of the vehicle to precisely follow guidance commands, assuming the vehicle loads are within acceptable limits. It was revealed that the

digital adaptive filter is highly effective in stabilizing the bending and slosh modes and that it is an adequate means for improving the transient response to step command inputs to a large launch vehicle. D.T.

N66-22365*# Wyle Labs., Inc., Huntsville, Ala. Testing Div.
LOWEST AXISYMMETRIC BODY MODES OF VIBRATION OF THE APOLLO VEHICLE
Nazeer Ahmed 25 Mar. 1966 31 p refs
(Contract NAS9-4305)
(NASA-CR-65322; WR-66-16) CFSTI: HC $2.00/MF $0.50 CSCL 22D

The lowest axisymmetric body modes of vibrations of the ring stiffened Apollo type vehicle are studied by means of a Rayleigh-Ritz procedure. A method is developed for converting the ring stiffened structure into an equivalent orthotropic, truncated, conical shell. It is found that stiffening the circumferential rings has the same effect on the natural frequency of vibration of the conical shell structure as that of increasing its thickness whereas increasing the cross stiffness has very little effect on the natural frequency. Results for the equivalent isotropic shell are determined as a special case of the equivalent orthotropic shell and are found to be in good agreement with those predicted by Love. In an appendix, a method is developed to estimate the vibration frequencies of the panels between shell stiffeners by assuming them to be equivalent to simply supported orthotropic rectangular plates with no curvature. Coupled vibration modes of the Apollo structure in the intermediate and critical frequency range between low frequency launch vehicle modes and high frequency, high-density modes of the primary and secondary structure may be analyzed. Author

N66-22382# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILITY OF ELASTIC SYSTEMS
A. S. Vol'mir 15 Nov. 1965 1045 p refs Transl. into ENGLISH of the book "Ustoychivost' Uprugikh Sistem" Moscow, Gos. Izd. Fiz.-Mat. Lit., 1963 p 1-879
(FTD-MT-64-335; AD-628508) CFSTI: HC $13.45/MF $4.00

The author sets himself the goal to summarize research in those sections of the theory of stability of bars, plates and shells, which have at present the greatest practical value. In the book there is considered a series of new problems, appearing in recent years in connection with requirements of industry (especially aircraft construction) and construction. There are presented, in particular, theoretical and experimental data obtained by the author and his colleagues on dynamic stability of elastic systems, buckling of shells 'in the large' during creep, etc. In the book are given tables and graphs, which can be directly used in practical calculations. There are given certain numerical examples. Author (TAB)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N66-21138# United Kingdom Atomic Energy Authority, Windscale (England). Reactor Development Lab.
HEAT TRANSFER FROM SURFACES ROUGHENED BY SQUARE RIBS AT A PITCH-TO-HEIGHT RATIO OF 7.2
D. Wilkie 1965 22 p refs
(TRG-987(W))

Heat transfer and pressure drop data are presented for surfaces roughened by square ribs at a pitch-to-height ratio of 7.2, and height-to-equivalent-diameter ratios ranging from 0.004 to 0.104 over a range of Reynolds number from 9×10^4 to 10^6. The tests, which were with air, provided an estimate of the effect of temperature ratio on friction factor. Author

N66-21158# Atomic Weapons Research Establishment, Aldermaston (England).
THE FUNDAMENTAL EQUATIONS OF RADIATION HYDRODYNAMICS
A. R. Fraser Jan. 1966 29 p refs
(AWRE-O-82/65) HMSO: 4s

The radiative transfer equation is derived for an absorbing and scattering fluid in motion. The equations of hydrodynamics are extended to include terms due to the radiation field. Author

N66-21200# Stanford Research Inst., Menlo Park, Calif.
DIFFUSION AND HETEROGENEOUS REACTION. VIII: HEAT TRANSFER IN REACTING GASES
Henry Wise, Bernard J. Wood, and Yapa Rajapakse Nov. 1965 27 p refs Submitted for Publication
(Contract Nonr-3623(00); Proj. Squid)
(SRI-22-P; AD-626061) CFSTI: HC $2.00/MF $0.50

Measurements were made of heat transfer through gas mixtures containing atomic and molecular oxygen. In the presence of catalytic surfaces the collisional energy transfer is augmented by chemical enthalpy transport. The magnitude of the increase in heat flux is a function of atom density, total gas pressure, and catalytic surface activity. The relative values of the thermal accommodation coefficient of atomic and molecular oxygen are deduced from the changes in temperature jump distances. Also, a theoretical analysis is presented of heat conduction through a gas located between coaxial cylinders of different length. Author (TAB)

N66-21229*# National Biomedical Research Foundation, Silver Spring, Md.
THERMODYNAMIC EQUILIBRIA IN PLANETARY ATMOSPHERES
Ellis R. Lippincott (Md. Univ.), Richard V. Eck, Margaret O. Dayhoff, and Carl Sagan (Harvard Univ.) [1965] 38 p refs Prepared in cooperation with Md. Univ. and Harvard Univ.
(Grant NGR-21-003-002)
(NASA-CR-69829) CFSTI: HC $2.00/MF $0.50 CSCL 20M

From present information on the composition, pressures, and temperatures of planetary atmospheres, the expected thermodynamic equilibrium composition of the atmospheres of the Earth, Venus, Mars, and Jupiter is calculated. Departures from thermodynamic equilibrium must be attributed to special mechanisms, including, on the Earth, biological activity. The major constituents of the terrestrial atmosphere are found to be in approximate thermodynamic equilibrium; while many minor constituents have abundances exceeding their equilibrium values, there is a marked tendency for equilibrium to be restored. It appears that the atmosphere of

Venus is in thermodynamic equilibrium, while that of Jupiter is not. The evidence for Mars is less conclusive, although not inconsistent with thermodynamic equilibrium. For none of these planets is there a molecular species with a large predicted equilibrium abundance and spectroscopically accessible absorption features which has not been already identified. The predicted equilibrium abundances of oxides of nitrogen are extremely low on all planets. The measured upper limits on the abundances of Cytherean CH_4, NH_3, and CO are all inconsistent with the possibility of elemental carbon or organic molecules in contact with the atmosphere of Venus either on the surface or as clouds. The possibility of small quantities of oxygen on Mars is not excluded. It is suggested that the colored materials at the Jovian clouds are organic molecules, produced by non-equilibrium processes in a reducing environment. Author

N66-21290# Purdue Univ., Lafayette, Ind. Jet Propulsion Center.

LIQUID-FILM COOLING, ITS PHYSICAL NATURE AND THEORETICAL ANALYSIS

R. A. Gater, M. R. L'Ecuyer, and C. F. Warner Oct. 1965 119 p refs

(Contract Nonr-1100(21))

(JPC-413; TM-65-6; AD-627028) CFSTI: HC $4.00/MF $0.75

A discussion of the physical nature of liquid-film cooling gives special emphasis to those phenomena occurring at the gas-liquid interface. The interfacial mass and heat balances are discussed in detail, together with the phenomena of film instability and the entrainment of liquid by the gas stream. A review is presented of the pertinent heat-mass transfer analyses for the wall region wetted by the liquid film. The limitations of those analyses are noted, and an alternate correlation procedure is suggested that is applicable to the case where the gas flow is compressible and subject to the influence of a streamwise pressure gradient. In order to implement that correlation procedure, a method is developed whereby the temperature at the gas-liquid interface can be approximated analytically. A heat transfer analysis is presented for the wall region downstream of the liquid film. That analysis is based on a relatively simple flow model, and is applicable to the case where the gas flow is compressible and subject to the influence of a streamwise pressure gradient. Two wall conditions are considered: (a) the case where the wall is adiabatic; and (b) the case where the wall is cooled externally. Author (TAB)

N66-21304# Manlabs, Inc., Cambridge, Mass.

COMPUTATIONAL PROBLEMS IN THE THERMODYNAMICS OF PHASE EQUILIBRIA AND VAPORIZATION KINETICS Semiannual Report

Sep. 1965 68 p

(Contract AF 33(615)-2352)

(SAR-1; AD-627387) CFSTI: HC $3.00/MF $0.75

Numerical predictions are made of certain equilibrium thermodynamic features of real systems: phase limits, vapor pressure, congruent vaporization, compositions, eutectic points, melting point maxima, composition dependence of the heats of formation of compounds, etc. This theoretical model can be used to correlate diverse thermochemical data. The equilibrium phase diagram is calculated, using statistical thermodynamical models of certain homogeneous phases, namely a regular solution phase (solid or liquid) and a non-stoichiometric solid compound phase. TAB

N66-21428# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DETECTION OF FREE HYDROGEN AND OXYGEN ATOMS IN A RAREFIED FLAME OF CARBON MONOXIDE AND OXYGEN MIXTURE IN PRESENCE OF SMALL ADMIXTURES OF ETHYLENE

V. V. Azatyan, Yu. M. Gershenzon et al 17 Sep. 1965 7 p refs Transl. into ENGLISH from Izv. Ser. Khim. Nauk (USSR), v. 16, no. 3, 1963 p 201–203

(FTD-TT-65-780/1+2+4; AD-622388) CFSTI: HC $1.00/MF $0.50

The investigation was conducted to check the mechanism of combustion of carbon monoxide in presence of ethylene by detecting free oxygen and hydrogen atoms in it and by measuring their concentration. Experiments were conducted with a stoichiometric mixture of carbon monoxide and oxygen, containing from 0.09 to 2.9% of ehtylene. The temperature of the experiments was 670–675°C, pressure −5 mm Hg. Volumetric rate of the stream was 25 cm^3/sec at normal conditions, which corresponded to a linear rate, equaling 4.4 m/sec under flame conditions. In these conditions EPR signals of hydrogen and oxygen atoms were registered. Concentrations of H and O atoms with increase in ethylene content in the mixture rise at first and then decrease. The hydrogen and oxygen concentration is comparable in value. The initial content of ethylene, at which the concentration of oxygen atoms is maximum, is close to the ethylene concentration, at which the lower limit of spontaneous ignition of the mixture is minimum (0.2%). With a rise in temperature the concentrations of H and O atoms increase, indicating that combustion under experimental conditions is not much greater. (TAB)

N66-21438*# Cedars of Lebanon Hospital, Los Angeles, Calif. Inst. of Medical Research.

A TECHNIQUE FOR TESTING HEART FUNCTION BY ANALYSIS OF ITS VIBRATION SPECTRUM Progress Report, Jul. 31–Dec. 31, 1965

Clarence M. Agress [1965] 14 p

(Grant NsG-289)

(NASA-CR-71524) CFSTI: HC $1.00/MF $0.50 CSCL 06P

Consideration is given to the refinement of external methods for estimating cardiovascular parameters, and an examination of contractility indices in animals. These considerations are made relative to determining a technique for testing the heart functions by an analysis of its vibration spectrum. Included are examinations concerned with a rate prediction for the left ventricular pressure rise, a prediction for stroke volume, and an application of these techniques to human subjects. C.T.C.

N66-21516# Brown Univ., Providence, R. I. Div. of Applied Mathematics.

SURFACE TEMPERATURES OF TWO RUBBING BODIES

George T. Symm Dec. 1965 25 p refs

(Contract Nonr-562(36))

(AD-627429) CFSTI: HC $1.00/MF $0.50

An investigation is described into the behavior of the surface temperatures of two rubbing bodies as the velocity of one of them tends to zero. An examination of the partition of heat between the two bodies is included. Author (TAB)

N66-21587# United Kingdom Atomic Energy Authority, Harwell (England). Chemical Engineering Div.

MEASUREMENTS OF BURNOUT HEAT FLUX IN UNIFORMLY HEATED ROUND TUBES AT 1000 p.s.i.a.

A. W. Bennett, G. F. Hewitt, H. A. Kearsey, and R. K. F. Keeys Nov. 1965 41 p refs
(AERE-R-5055)

Experiments are described in which the "burnout" or "critical" heat flux has been determined for heat transfer to steam-water mixtures in uniformly heated round tubes at 1000 p.s.i.a. The tubes were 0.497 in and 0.375 in (approx.) in diameter and between 6 and 19 ft in heated length. Subcooled water was introduced at the inlet of the tube and the steam phase generated within the test section. The maximum length used was somewhat greater than that which has been reported previously in the literature; the burnout power was found to increase markedly with heated length for high mass velocities but to change by only a small amount at low mass velocities. The data were compared with four recent burnout correlations, all of which were found to perform, on average, about equally well. There were, however, regions in which particular correlations were found to be inadequate. The secondary variables of inlet throttling, tube wall thickness, and lagging were investigated and found to have little effect. Comparisons were also made with data obtained for nominally the same conditions with physically identical test sections in other equipment at A.E.E. Winfrith; there was good agreement between results obtained in the various experimental rigs. Author

N66-21596# Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France). Division Satellites.
EXCHANGE OF RADIANT ENERGY BETWEEN DIFFUSED SURFACES [ECHANGE D'ENERGIE RADIANTE ENTRE SURFACES DIFFUSANTES]
C. Elbaz Feb. 1966 22 p refs In FRENCH
(CNES-NT-3) CFSTI: HC $1.00/MF $0.50

In order to account for the multiple reflections of radiation, integral equations were derived giving the reciprocal thermal emissivity between two plane and/or convex surfaces, and the effective emissivity for a concave surface. Applications to the determination of heat exchange in the interior of a satellite are presented. Transl. by D.T.

N66-21660*# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.
SEPARATED BASE FLOW HEAT TRANSFER ANALYSIS
Terry F. Greenwood Nov. 1965 36 p refs
(Contract NAS8-20169)
(NASA-CR-71409; R-168) CFSTI: HC $2.00/MF $0.50 CSCL 20M

This report describes an analytical method for predicting the heat transfer to the base of a wedge or rearward facing step from a separated, turbulent, supersonic flow. Calculated values are compared with experimental data. Author

N66-21678# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEWS OF THE ACADEMY OF SCIENCES OF THE USSR. MECHANICS AND MACHINE BUILDING Selected Articles
5 Apr. 1965 20 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd., Tekhn. Nauk: Mekhan i Mashinostr. (Moscow), no. 1, 1964 p 115-120, 199-201
(FTD-TT-64-1088/1+2; AD-615990) CFSTI: HC $1.00/MF $0.50

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N66-21677 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SIMILARITY OF TEMPERATURE PROFILES IN BODIES AT FREE MOVEMENT IN ATMOSPHERE AT HYPERSONIC VELOCITIES AT HIGHER ALTITUDES
I. N. Murzinov *In its* News of the Acad. of Sci. of the USSR. Mech. and Machine Bldg. 5 Apr. 1965 p 1-10 refs (See N66-21671 11-34) CFSTI: HC $1.00/MF $0.50

Similarity conditions of temperature profiles in bodies entering the atmosphere at hypersonic velocities are discussed. It was established that temperature profiles along the larger part of the trajectory are determined by a single parameter, as long as the rate of motion of the bodies is constant. Similarity parameters mentioned are conditions of carrying away the mass and consideration of the physical and chemical conversions in the material. M.R.W.

N66-21694*# Delaware Univ., Newark.
THE ECKERT REFERNCE FORMULATION APPLIED TO HIGH-SPEED LAMINAR BOUNDARY LAYERS OF NITROGEN AND CARBON DIOXIDE
H. A. Simon, C. S. Liu, and J. P. Hartnett Washington, NASA Apr. 1966 12 p refs
(Grant NsG-356)
(NASA-CR-420) CFSTI: HC $0.15/MF $0.50 CSCL 20M

The reference temperature equation for laminar boundary layers on constant temperature and pressure surfaces $T=T_s+0.50(T_w-T_s)+0.22(T_r-T_s)$, where T is the temperature, r represents recovery, s is the free stream, and w means wall location, was used to approximate high speed laminar boundary layers of nitrogen and carbon dioxide on similar surfaces. It was found that reference enthalpy rather than reference temperature values had to be used for wide range specific heat variations or when dissociation occurred. For the latter cases the following formula was developed: $i=i_s+0.5(i_w-i_s)+0.22(i_r-i_s)$ where i represents enthalpy. G.G.

N66-21756# Astrosystems International, Inc., Fairfield, N. J.
AIR FORCE OFFICE OF SCIENTIFIC RESEARCH SIXTH ANNUAL CONTRACTOR'S MEETING ON CHEMICAL KINETICS OF PROPULSION
[1965] 46 p refs Meeting held in Pittsburgh, 20-21 Sep. 1965
(Contract AF 49(638)-1400)
(AFOSR-65-2238; AD-627978) CFSTI: HC $2.00/MF $0.50

The conference agenda and abstracts of the various papers are presented. Subject matter covered includes ion-molecule reactions in flames; concept of a mean temperature in flame reaction zone; energy distribution in the products of reactions in flames and electrical discharge; plasma jet chemistry; thermal reaction inhibition between hydrogen and oxygen; metallic beryllium combustion; kinetics of fluorine compound reactions; cyclopropane derivatives containing fluorine; hydrogen-fluorine reaction; combustion kinetics of tetrafluorethylene; chemical synthesis with ion beams; chemical

reactions on clean surfaces with modulated atomic beam techniques; physics of metastable systems; helium ion interaction with metallic surfaces; combustion gas emitted radiation and chemiluminescence phenomena; high temperature chemical kinetics; decomposition kinetics of ammonium perchlorate; sticking probability of hydrocarbons on tungsten; kinetic and aerodynamic aspects of the attack of refractory materials by dissociated gases; interfacial rate processes in flow systems; kinetics of hydrogen–oxygen and hydrocarbon–oxygen reactions; and chemical reactions in a monothermal field. M.G.J.

N66-21781*# California Univ., Berkeley.
INFRARED RADIATION MEASUREMENTS OF COMBUSTION GASES Fourth Quarterly Progress Report, Apr. 1–Jun. 30, 1965
M. M. Abu-Romia, W. H. Giedt, and C. L. Tien 15 Jul. 1965 12 p refs
(Contract NAS8-11468)
(NASA-CR-71542) CFSTI: HC $1.00/MF $0.50 CSCL 20M

Spectral absorption measurements of the carbon dioxide fundamental band at 1500°K were obtained, using improved stainless steel holders for the sapphire windows. The pressure was varied from 0.5 to 3 atmospheres, and the optical path length from 5 to 20 centimeters. Graphs for the 5 and 10 cm path lengths are presented. Comparisons with previous data show that, in general, as the temperature is increased there is a reduction in the maximum absorptivities and a shifting of the wave members at which the maximums occur. N.E.N.

N66-21788# General Electric Co., Philadelphia, Pa. Missile and Space Div.
THE HYPERVELOCITY HEAT PROTECTION PROBLEM
N. S. Diaconis, T. E. Shaw, and W. R. Warren, Jr. Nov. 1965 86 p refs Presented at the 16th IAF Intern. Congr., Athens, 12–18 Sep. 1965
(R65SD60; AD-474978)

Analytical and experimental techniques for the evaluation of ablation heat protection materials for use in hypervelocity entry flight regime have been described. The analytical procedures used to predict the ablation material performance along an entry trajectory were evaluated and phenomenologically adjusted by comparison with ground facility experimental results. It has been shown that graphite as an ablation material closely follows its predicted response mechanics over a range of environmental conditions. It has also been shown that graphite is an attractive material for the protection of conical bodies entering an atmosphere under very severe convective heating conditions. Under the assumption that charring plastic ablators are attractive heat protection materials for hypervelocity entry environments dominated by radiative heating, an approach has been developed which allows an evaluation on a phenomenological basis of their ablation performance. Experimental techniques were used to simulate a method for including the complex absorption and coupled boundary layer processes that exist under such entry situations. For an assumed entry flight situation with severe radiative heating, this heating mechanism leads to a significant increase in total material degradation compared to that obtained with simple prediction methods.
Author (TAB)

N66-21808*# California Univ., Davis.
INFRARED RADIATION MEASUREMENTS OF COMBUSTION GASES Sixth Quarterly Progress Report, 1 Oct.–31 Dec. 1965
W. H. Giedt [1966] 16 p
(Contract NAS8-11468)
(NASA-CR-71526) CFSTI: HC $1.00/MF $0.50 CSCL 20M

Modifications in mounting arrangements and a window holder used to define the test path length are reported for an experimental apparatus designed to obtain the spectral characteristics of a number of common combustion products. The key element in this apparatus is a graphite resistance furnace with an inert ceramic tube liner for the containment of high temperature gases. A beam of radiation from a high temperature source is directed through a known length of test gas in the center region of the furnace. A monochrometer on the opposite end of the furnace is then used to measure the amount of energy absorbed as a function of wavelength. C.T.C.

N66-21825*# Alabama Univ., University. Bureau of Engineering Research.
TRANSIENT HEAT TRANSFER STUDIES Final Report
Raymond M. Hollub Jan. 1966 162 p refs
(Contract NAS8-5217)
(NASA-CR-71533) CFSTI: HC $5.00/MF $1.00 CSCL 20M

A large number of measured heat transfer film coefficients were assembled for the dead-end portion of "T" and "Y" type sections of round tube, when gas flow exists in an adjacent section. The coefficients, evaluated by computer reduction of experimental test data, are presented for test sections of 1.25, 2.50, and 4.0 inches diameter. Velocity measurements were made, visualization was accomplished and filmed, and gas flow behavior was described quantitatively for all geometric arrangements. Heat transfer film coefficients within the dead-end portion adjacent sections were correlated with the local velocity and the free stream velocity, Reynolds number, angular geometry, and the dead-end section length. The maximum values for the coefficients measured within the dead-end section, and values extrapolated to the intersection of adjacent sections were all significantly less than the values calculated by accepted methods for predicting heat transfer coefficients in straight tube walls. C.T.C.

N66-21946# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.
RADIATION EFFECTS IN THE STAGNATION REGION BOUNDARY LAYER Technical Report No. 119
Joseph Shwartz Nov. 1965 56 p refs
(Grants AF-AFOSR-62-407; AF-AFOSR-614-64)
(AFOSR-66-0129; AD-628547) CFSTI: HC $5.60/MF $0.75

The radiation coupled boundary layer of an emitting and absorbing gas at the stagnation region of a blunt body is considered. Solutions are obtained for a wide range of optical thicknesses and radiation intensities, including the radiative effects of the adjoining shock layer. The solutions indicate the decrease in temperatures, their gradients, and the related conductive heat transfer to the wall as well as the net radiant energy contribution. The results are shown for a range of optical thicknesses from thin to effectively thick, with the major effects of radiation found to exist for the former extreme. Author (TAB)

N66-21966# California Univ., Berkeley. Dept. of Mechanical Engineering.
FLAME PROPAGATION RATES IN THE COMBUSTION OF AMMONIA Technical Report No. 5

G. S. Samuelsen 9 Sep. 1965 47 p refs
(Contract DA-04-200-AMC-791(X))
(TS-65-4; AD-627409) CFSTI: HC $2.00/MF $0.50

An investigation was made of the flame propagation rates and peak pressures of ammonia as compared to iso-octane in spark ignition engine combustion. The influence of compression ratio, speed, manifold pressure, and dissociation of ammonia prior to combustion was studied as a function of equivalence ratio (ϕ). The ammonia kernel development proved to be 1.4 times greater than the 2.72 millisecond average recorded with iso-octane. The maximum ammonia flame rate was 59 fps at ϕ=0.85 and, for iso-octane, 83 fps at ϕ=1.23. While the propagation rates of iso-octane fell uniformly on either side of maximum, the ammonia flame rates dropped rapidly on the rich side of maximum through an inflection point. Prior partial dissociation of ammonia, before introduction to the engine, was found to be of prime importance to flame speeds, becoming more critical for leaner mixtures. Author (TAB)

N66-21969# United Kingdom Atomic Energy Authority, Risley (England).
HEAT TRANSFER AND FRICTIONAL RESISTANCE OF A HIGH-TEMPERATURE GAS FLOW
A. A. Ter-Oganes'yants and S. N. Shorin [1965] 15 p refs Transl. into ENGLISH from Teploenerg. (Moscow), no. 2, 1965 p 83–86 In ENGLISH and RUSSIAN
(NP-TR-1300) CFSTI: HC $1.00/MF $0.50

On the basis of a study of measurements of the heat transfer and frictional resistance of a high-temperature gas flow and comparison with the measurement results of others, an attempt was made to derive formulas corresponding to the analogy between the transfer of heat and transfer of momentum. The heat transfer and frictional resistance were measured in separate sections of a tube at comparatively high numbers $\Psi = T/T_W$ (up to 3.9), and the effects of the state of the surface on the heat transfer and resistance were studied. It was concluded that in the case of complex convective-conductive-radiant heat transfer, and because of the simplification of the calculation formulas of the Stenton number, the Nusselt number is to be preferred. NSA

N66-21972# California Univ., Livermore. Lawrence Radiation Lab.
FINITE DIFFERENCE METHODS FOR NONLINEAR RADIATION TRANSPORT
Philip M. Campbell 20 Aug. 1965 23 p refs
(Contract W-7405-ENG-48)
(UCRL-12411) CFSTI: HC $2.00/MF $0.50

A formulation is given of the nonlinear, frequency-dependent transport problem in one dimension, assuming local thermodynamic equilibrium. Equivalent representations of the angular distribution are discussed, including the treatment of discontinuities. A method for the combination of transport and diffusion based on the equivalence of the angular representations is presented. The performance of this method is illustrated in a variety of sample calculations. Author (NSA)

N66-22013# Welsh Coll. of Advanced Technology, Cardiff.
THERMAL RESISTANCE OF PRESSED CONTACTS
T. R. Thomas and S. D. Probert Risley, England, United Kingdom Atomic Energy Authority, 28 Jul. 1965 30 p refs
(TRG-1013(R/X)) HMSO: 4s 6d

A review of theoretical results and experimental data is presented. It is concluded that the most promising line of attack on problems concerning thermal contact conductances is the use of surface analyzers with data-processing equipment to record surface parameters in great detail. Experimentally, there are very large differences between the results of different workers using apparently very similar specimens. There is a need for a standard specimen to be circulated among workers in the field. Author (NSA)

N66-22069# Temple Univ., Philadelphia, Pa. Research Inst.
THERMAL CONDUCTIVITY OF LIQUID METALS OVER THEIR ENTIRE LIQUID RANGE, I.E., FROM MELTING POINT TO CRITICAL POINT, IN RELATION TO THEIR ELECTRICAL CONDUCTIVITIES AND THE FALLACY OF DIVIDING METALS INTO "NORMAL" AND "ABNORMAL" THERMAL CONDUCTING ONES
Aristid V. Grosse 7 Dec. 1964 76 p refs
(Contract AT(30-1)-2082)
(TID-21737) CFSTI: HC $3.00/MF $0.75

Metals are usually divided into "normal" and "abnormal" thermally conducting metals depending on whether their conductivity decreases or increases with rising temperature. Examples of the "normal" metals are sodium and potassium, while mercury is a typical representative of the "abnormal" ones; while sodium and potassium are "normal," their alloys—the well-known "NaK-alloys"—are "abnormal." It is shown that the above division is a fallacy. Using the recently found relation between the electrical conductivity of a liquid metal and its temperature over its entire liquid temperature range and the Wiedemann–Franz law, the thermal conductivities of the liquid metal, again over its entire liquid range, can be estimated. It is found that all or nearly all metals, except potassium and sodium, show the "abnormal" behavior. It is suggested to call this "abnormal" behavior regular from now on; thus, only potassium and sodium show irregular behavior. Author (NSA)

N66-22152# Los Alamos Scientific Lab., N. Mex.
HEAT CAPACITIES OF $NbC_{0.702}$, $NbC_{0.825}$, $NbC_{0.989}$ AND Nb_2C BELOW 320°K
Thomas A. Sandenaw and Edmund K. Storms [1964] 21 p refs
(Contract W-7405-ENG-36)
(LA-DC-6565) CFSTI: HC $1.00/MF $0.50

The heat capacities of the niobium carbides were measured between 7°K and 320°K using an adiabatic calorimeter. Author (NSA)

N66-22157# Los Alamos Scientific Lab., N. Mex.
THE GENERATION OF OSCILLATIONS HAVING ACOUSTIC PROPERTIES IN FORCED CONVECTIVE HEAT TRANSFER TO CRYOGENS
Rodney S. Thurston [1965] 13 p refs Presented at Symp. on Heat Flow below 100°K and its Technol. Appl., Grenoble, France
(Contract W-7405-ENG-36)
(LA-DC-6945; CONF-650611-1) CFSTI: HC $1.00/MF $0.50

Heat transfer has been known to be capable of inducing acoustic phenomena for more than 100 years. In relatively recent heat transfer experiments, which developed large radial gradients of physical properties, oscillations at acoustic frequencies have been observed. These cases have included gaseous flow at very high heat fluxes, and heat transfer to fluids undergoing a change of phase or in the

supercritical region. Investigations were made of pressure oscillations appearing in forced convective heat transfer to initially liquid nitrogen and hydrogen in long small diameter flow channels. Some of the observed oscillations had characteristics similar to open-open pipe resonance and Helmholtz resonance. An analogy is presented between this phenomenon and that occurring in the Rijke tube, which was discovered in the last century. Author (NSA)

N66-22256*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE DIRECTIONAL RADIATIVE CHARACTERISTICS OF CONICAL CAVITIES AND THEIR RELATION TO LUNAR PHENOMENA

Leslie G. Polgar and John R. Howell Washington, NASA, 1965 15 p refs Presented at the AIAA/ION Astrodyn. Specialists Conf., Monterey, Calif., 16–17 Sep., 1965

(NASA-TM-X-52090) CFSTI: HC $1.00/MF $0.50 CSCL 20M

An analytical study of the directional absorptivity characteristics of conical cavities is presented in an attempt to model the reflectivity characteristics of the lunar surface. A beam of parallel radiation is taken as striking a right circular conical cavity at a given angle of incidence to the cone axis. The cone is assumed to have a diffusely reflecting surface and has a given cone angle. A Monte Carlo analysis is used to determine the directional reflectivity of the cone. Parameters varied are the cone angle, surface absorptivity, and angle of incidence of the solar radiation. A comparison is then made to the lunar characteristics. The directional reflectivity of a right circular cone with a 30° cone angle and a 0.5 surface absorptivity compared well with experimental photometric results for the lunar surface. This infers that the lunar surface could have steep walled cavities larger than visual wavelengths. Results for conical cavities with cone angles near those for observed lunar craters do not correlate with observed lunar photometric results, implying that they contribute little to the lunar reflectivity characteristics. R.N.A.

N66-22261*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CALCULATION OF RADIANT HEAT EXCHANGE BY THE MONTE CARLO METHOD

John R. Howell Washington, NASA, 1965 26 p refs Presented at the ASME Winter Ann. Meeting, Chicago, 7–11 Nov. 1965

(NASA-TM-X-52101) CFSTI: HC $2.00/MF $0.50 CSCL 20M

Because of the complex nature of radiative heat-transfer calculations in many practical cases, especially where surfaces are involved, the use of digital computing machines becomes mandatory. It follows that methods that take advantage of the assets of these computers should be utilized. The Monte Carlo method is discussed as a means of solving radiative-transfer problems, and the literature dealing with its application is reviewed. An example problem is presented and discussed with regard to a Monte Carlo solution. Applications of the method to general problems in radiation are pointed out, and the areas where advantages over more conventional techniques exist are examined. Author

N66-22302*# National Aeronautics and Space Administration, Washington, D. C.

COMBUSTION OF A CARBON PARTICLE MOVING IN A GAS FLOW [GORENIYE UGOL'NOY CHASTITSY, DVIZHUSHCHEYSYA V POTOKE GAZA]

Z. S. Leont'yeva Feb. 1966 26 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk (Moscow), no. 12, Dec. 1951 p 1801–1811

(NASA-TT-F-10000) CFSTI: HC $2.00/MF $0.50 CSCL 20M

The descending (free fall) motion of a burning spherical carbon particle in an upstream of air is photographed, the kinematics are analyzed and compared with the equivalent motion of an identical nonburning sphere, hence with the analogous problem without surface chemical reaction. The essential difference is a three- to fourfold increase in drag on the burning (reacting with the flowing medium) particle. An analysis is carried out in terms of the mechanics of a variable-mass point (used in the kinematic treatment of a fuel-dissipating rocket. It is found that the resultant velocity of the escaping mass is dependent on the types of fuel constituting the particle, in this case carbon in the form of (1) electrode carbon; (2) charcoal, hence on the chemical reactivity of the material, as well as the composition of the medium. In a nonenriched air medium, the proportions of CO and CO_2 are roughly equal, the former increasing over the latter with temperature. Author

N66-22311 Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany).

MEASUREMENTS OF RELAXATION EFFECTS IN NOZZLE FLOW OF HOT COMBUSTION GASES BY MEANS OF A SHOCK TUBE TECHNIQUE

Th. Just. *In* AGARD Aerodyn. of Power Plant Installation, Pt. 1 Oct. 1965 p 153–171 refs (See N66-22306 11-01) CFSTI: HC $7.00/MF $2.00

The paper describes a modified line reversal technique which permits measurement of temperatures during short time intervals in relaxing nozzle flow. The high temperatures of combustion gases needed were produced by shock driven detonations in a shock tunnel. Preliminary results are given. Author

N66-22335* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

INFRARED SPECTRAL TRANSMITTANCES FOR DETERMINING RADIANT FLUX OF INHOMOGENEOUS GASES

Robert M. Huffaker *In its* Aero-Astrodyn. Res. Rev. No. 3 15 Oct. 1965 p 39–43 (See N66-22329 11-34) CFSTI: HC $4.00/MF $1.00

A general method has beeen developed to calculate spectral transmittances of inhomogeneous gases from the properties of homogeneous gases. Thus, any calculation of spectral transmittance for a particular inhomogeneous gas path can be done by properly combining known band model data on gases at constant temperature, pressure, and concentration. The method developed is based principally on two special spectroscopic concepts: (1) the molecular band model, and (2) the Curtis–Godson approximation. This method has been experimentally verified over the temperature, pressure, and wavelength range typical of Saturn V exhausts. Author

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N66-21107# Planning Research Corp., Los Angeles, Calif.
FLIGHT CONTROL DATA AND INFORMATION EXCHANGE PROGRAM. PART I: INVESTIGATION OF NEED AND FEASIBILITY Technical Report, Jun. 1964–Apr. 1965
H. E. Dye, C. E. Bloomquist, and C. H. Wilmot Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Nov. 1965 58 p refs Prepared for Systems Technology, Inc.
(Contract AF 33(615)-1818)
(AFFDL-TR-65-120, Pt. I; AD-626923) CFSTI: HC $3.00/MF $0.75

The document reports the results of an investigation of the need for a permanent flight control data and information exchange program. Direct mail questionnaires were used to solicit the opinions of flight control specialists. The results of the opinion survey are summarized. Three major abstracting and announcement media were critically examined from the standpoint of identifying information relevant to flight control systems. A literature survey was also conducted to determine the current status of technical documentation and dissemination. A group of specialized information centers of interest to flight control specialists are described. Based upon the findings, the general structure and guidelines are presented for a specialized information center designed solely to satisfy the information needs of flight control specialists. Author (TAB)

N66-21115# Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS
L. S. Birks et al Nov. 1965 53 p refs
(PB168622)

Techniques and experiments with neighboring elements are described to determine the limitations and precision of X-ray energy dispersion spectrochemical analysis. It is shown that the method is best suited to analysis of major constituents, i.e., above three percent composition; precision is within a few percent. Stainless steels and high temperature alloys are used as examples, but the results are equally applicable to other types of specimens. The advantages of high intensity and simple equipment are said to make the method attractive for a variety of uses. Two wide range chemical dosimeter systems were investigated for use with high intensity radiation fields. It was found that hypobromite is a very efficient radical scavenger that may be useful for dosimetry at very high dose rates, and that the reduction of 0.4M potassium bromate provides linear response up to an absorbed dose of 200 megarads. Work is also reported in astrophysics, chemistry, mechanics, metallurgy and ceramics, nuclear and atomic physics, optics, and radio. D.T.

N66-21128# United Kingdom Atomic Energy Authority, Risley (England). Research and Development Branch.
A SURVEY OF THE USE OF LITERATURE AND INFORMATION IN THE R. AND D. BRANCH
I. H. Hogg and J. Roland Smith 1965 78 p refs Reprinted (IG-23(RD/R)) HMSO: 10s

A limited survey of scientists was conducted to determine (a) how efficiently the Group library and information services met the scientists needs, and (b) the ways in which scientists used scientific and technical information and their requirements for it. Although the survey criteria were indicated to be generally unsuitable, it was concluded that the literature provided by the libraries in most cases satisfied the users and represented half their reading. The libraries were responsible for notifying scientists of 14% of all their reading, and about 25% of reading based on references. Other conclusions involved physical facilities, foreign language periodicals, private data indexes, and older periodicals. The recommendations included: (1) More publicity should be given to library and information services. (2) A strengthened library staff should give more individual service. (3) Scientists' reading capacity and discrimination should be increased. Also recommended were physical facility planning, indexing guidance, more accessible foreign literature, and personal communication improvements. E.A.O.

N66-21131# Congress. House. Committee on Science and Astronautics.
PANEL ON SCIENCE AND TECHNOLOGY. SEVENTH MEETING: GOVERNMENT, SCIENCE, AND PUBLIC POLICY
Washington, GPO, 1966 216 p Proc. before Comm. on Sci. and Astronautics, 89th Congr., 2d Sess., 25–27 Jan. 1966

Transcripts of the panel discussions on the relationships between government, science, and public policy are presented, along with the program agenda, biographical data on the participants, and follow-up communications. Interest centered on government's role in science education, science and social change, and science as an element of economic growth. Also considered were the development of social sciences, the regional distribution of scientific resources and facilities within the United States, the fostering of international careers in science, the relation of scientific discovery to basic political decisions, and the adequacy of the science budget. M.G.J.

N66-21134# Congress. House. Committee on Government Operations.
MISSILE AND SPACE GROUND SUPPORT OPERATIONS
Washington, GPO, 1966 115 p Twenty-Third Rept. by the Comm. on Govt. Operations, 89th Congr., 2d Sess., 21 Mar. 1966 House Rept.-1340

The Government's missile test and space range and tracking operations, representing a capital investment of over $4 billion, are surveyed, and the areas of similarity which can be combined for greater economy and efficiency are pointed out. Recognition is also given to the advantages of decentralization and of keeping support resources close to the programs and agencies which need them. The organization and growth of NASA and Department of Defense ground support activities is outlined, and NASA–DOD relationships and responsibilities are examined. Contract and funding arrangements are discussed, along with incentives to reduce costs, and the problems connected with service contracts. NASA's decision to use satellite communications for the Apollo program is also considered. Recommendations for achieving maximum joint use of facilities, standardized equipment, integrated operations, and effective advanced planning are proposed. M.G.J.

N66-21177# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
SURVEY OF LITERATURE ON INDUSTRIAL TECHNOLOGY [LITERATUUROVERZICHT BEDRIJFS WETENSCHAPPEN]
13 Jan. 1966 32 p refs In DUTCH, ENGLISH, FRENCH, and GERMAN *Its* Vol. 5, No. EM-94 CFSTI: HC $2.00/MF $0.50

Contains abstracts and bibliographic notes on general and industrial economy, (including internal organization, cost

considerations, financing, administration, and statistics), personnel, logistics (including general, acquiring, storing and transporting, material planning and control, and quality control), normalization, industrial sociology and psychology, and technical news. Transl. by J.O.

N66-21255*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
THE SPACE REVOLUTION NASA News Release
Winston E. Kock [1965] 24 p Presented at Engr. Club, Philadelphia, 25 Mar. 1966 Available from the Scientific and Technical Information Division CSCL 05C

The contributions by the space program to the U. S. industrial breakthrough in converting laboratory research into useful products is discussed. Certain trends which lead in this direction were reported as related to the space needs of size and weight reduction, reliability, and complexity. The great need for weight reduction and reliability was stressed, and the electronic microcircuits for radio and television sets and other home appliances was given as an illustration of their application. Another significant effect of the space program was shown to be the cooperation among many companies, necessitated by the complexity of space missions. Complex systems such as those used in control, guidance, and circuitry are now commonly applied in industry. N.E.N.

N66-21446# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO. 298
10 Mar. 1966 88 p refs Transl. into ENGLISH from Chinese Periodicals
(JPRS-34492; TT-66-20932) CFSTI: $3.00

CONTENTS:

1. CATALYTIC SYSTEM OF METALS-TRANSITION METAL HALIDES FOR THE POLYMERIZATION OF a-OLEFINS C.-h. Chu p 1-15 (See N66-21447 11-06)
2. CHEMISTRY OF CARBODIIMIDES T.-c. Lu p 16-38 refs (See N66-21448 11-06)
3. SOLAR AND STELLAR MAGNETIC FIELDS S.-h. Yeh p 39-55 refs (See N66-21449 11-30)
4. SURVEY OF ASTRONOMICAL CLIMATE AROUND PEKING AND SELECTION OF A SITE FOR THE PEKING OBSERVATORY p 56-69 refs (See N66-21450 11-30)
5. ON "MAN-MACHINE" SYSTEM H.-y. Tu p 70-78 (See N66-21451 11-05)

N66-21597# National Research Council of Canada, Ottawa (Ontario).
[NATIONAL RESEARCH COUNCIL'S CURRENT PROJECTS FOR DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT] Quarterly Bulletin, 1 Oct.-31 Dec. 1965
[1965] 160 p refs
(DME/NAE-1965(4)) CFSTI: HC $5.00/MF $1.00

Several research projects are presented including the reliability of fatigue test results, the numerical definition of ships' hulls by means of elastic interpolation, and the choice of working section size and shape for V/STOL wind tunnels. Also included are brief descriptions of current projects in the areas of analysis and computing techniques, control systems, engines, gears, flight research, fuels and lubricants, gas dynamics, high and low speed aerodynamics, hydraulics, instrumentation, low temperature research, ship design, structural materials, and unsteady aerodynamics. R.N.A.

N66-21645# Congress. Senate. Committee on Aeronautical and Space Sciences.
NATIONAL COMMUNICATIONS SATELLITE PROGRAMS
Washington, GPO, 1966 123 p Hearings before Comm. on Aeron. and Space Sci., 89th Congr., 2d Sess., 25-26 Jan. 1966 GPO: $0.35

This paper presents the hearings held before the Senate Committee on Aeronautical and Space Sciences to review the communications satellite programs, the relationship between government agencies on these programs, and the relationship between the government and the Communications Satellite Corporation. R.N.A.

N66-21653*# Illinois Univ., Urbana. Coordinated Science Lab.
COORDINATED SCIENCE LABORATORY Summary Progress Report, Sep.-Nov. 1965
21 Jan. 1966 122 p refs
(Grants NsG-376; NsG-443; NsG-504; NGR-14-005-038; Contract DA-28-043-AMC-00073(E) et al)
(NASA-CR-71396; AD-627094) CFSTI: HC $4.00/MF $1.00 CSCL 04A

Contents: Space sciences group, surface physics, computer, control systems, PLATO, vacuum instrumentation, plasma physics, superconductivity studies, thin films, information science, switching systems, networks and communication nets. TAB

N66-21675*# National Aeronautics and Space Administration, Washington, D. C.
NASA SPECIAL PUBLICATIONS, SPRING 1966 Bibliography
1966 41 p refs
(NASA-TM-X-57334) CFSTI: HC $2.00/MF $0.50 CSCL 05B

Presented is a compilation of monographs, state-of-the-art summaries, conference proceedings, handbooks, source books, histories, chronologies, charts, and selected bibliographies, as well as works directly resulting from NASA's Technology Utilization Program. The last group of publications reports innovations born of the needs of space exploration that are of potential worth to nonaerospace industry. The collection of scientific and technical information is derived from or valuable to the manifold activities of the National Aeronautics and Space Administration. M.R.W.

N66-21678 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EMPLOYMENT OF THE PHOTOELASTIC COATING METHOD TO DETERMINE STRESSES AND DEFORMATIONS IN FLEXIBLE PLATES AND SHELLS
M. Kh. Akhmetzyanov *In its* News of the Acad. of Sci. of the USSR. Mech. and Machine Bldg. 5 Apr. 1965 p 11-16 refs (See N66-21676 11-34) CFSTI: HC $1.00/MF $0.50

A method of investigating the stresses and deformations in elastic flexible plates and shells with the aid of photoelastic coatings is discussed. It is shown that equations can be used, on data from the polarization and optical investigation of coatings, for a quantitative determination of bending

deformation in rigid thin plates (where longitudinal forces are absent), when the trajectories of main bending deformations are determined with the aid of negated brittle coatings. M.R.W.

N66-21742# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
AEROSPACE RESEARCH, NUMBER 109, NOVEMBER–DECEMBER 1965 [LA RECHERCHE AEROSPATIALE, NUMERO 109, NOVEMBRE–DECEMBRE 1965]
[1966] 69 p refs In FRENCH; ENGLISH summary
CFSTI: HC $3.00/MF $0.75

The following studies are reported: (1) low speed of vortices over the upper surface of very slender wings in a water tunnel; (2) kinetic heating measurements on windtunnel models by thermosensitive paints; (3) theoretical and experimental work to find light casings for spherical shaped rocket motors; (4) performance characteristics of a mercury ion accelerator; (5) pyrolytic linear velocity measurements of ammonium perchlorate in one-dimensional flow by using a porous wall for gas flow-through; (6) electronic frequency selective device for resonance line control; and (7) descriptions and methods for vibration global testing of airliners or missiles to predict their aeroelastic behavior. G.G.

N66-21880# FMC Corp., Santa Clara, Calif. Central Engineering Labs.
ULTRA-HIGH COMPRESSION OF DRIED FOODS
R. A. Lampi, H. Takahashi, J. Lennon, R. F. Battey, and S. Sierra Natick, Mass., Army Natick Labs., Nov. 1965 64 p refs
(Contract DA-19-129-AMC-163(N))
(FD-35; AD-626193) CFSTI: HC $3.00/MF $0.75

The report covers the study of the effects of pressures as high as 120,000 psi on various dried foods. High compression did not produce any detectable chemical changes. Compressed foods became difficult to rehydrate and exhibited considerable fragmentation when hydrated. Temperature changes occurring during high compression operations were studied. The equipment used for achieving high pressures and the construction of the die are discussed. Author (TAB)

N66-21884# George Washington Univ., Washington, D. C.
AN ANALYSIS TO DETERMINE IF THE DEPARTMENT OF DEFENSE SHOULD OWN OR LEASE COMMUNICATIONS SATELLITES
Dondal Louis Steelman (M.S. Thesis) Sep. 1965 75 p refs
(AD-624678) CFSTI: HC $3.00/MF $0.75

Results of an analysis concerning the ownership and operation of communications satellite systems are presented. After a brief explanation of the nature of satellite communications, to orient the reader, the commercial and government needs and requirements for communications satellites are set forth, and the relationship of national policy to the communications Satellite Program are shown. An analysis of the alternatives for managing a global system to satisfy unique government requirements is summarized. M.R.W.

N66-22225# Federal Council for Science and Technology, Washington, D. C. Coordinating Committee on Materials Research and Development.
FEDERAL MATERIALS RESEARCH PROGRAM: OPPORTUNITIES, ROADBLOCKS, PROBLEMS
Nov. 1965 38 p refs
(TID-22424) CFSTI: $2.00

Problems, application opportunities, and roadblocks in high temperature material, high strength-light weight material, and material degradation research of general concern to Federal government activities are identified; and recommendations are made as to where research emphasis should be placed. Areas considered include ceramics, corrosion, surface studies, processing, mechanical properties, microstructures, characterization of crystal imperfections, structures, nature of superconducting properties, physical properties, and effects of radiation on the materials. L.S.

N66-22329*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AERO-ASTRODYNAMICS RESEARCH REVIEW NO. 3, JANUARY 1–JUNE 30, 1965
William D. Murphree, comp., and Sarah Hightower, ed. 15 Oct. 1965 126 p refs
(NASA-TM-X-53389) CFSTI: HC $4.00/MF $1.00 CSCL 22

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4. ON SOME AERODYNAMIC ASPECTS OF THE PANEL FLUTTER PROBLEM M. Platzer, R. Beranek, and L. Saunders p 23–32 refs (See N66-22333 11-32)

5. CONTINUOUS CARBON ABSORPTION STUDIES C. C. Ferriso, C. B. Ludwig (Gen. Dyn./Convair), and R. M. Huffaker p 34–38 (See N66-22334 11-28)

6. INFRARED SPECTRAL TRANSMITTANCES FOR DETERMINING RADIANT FLUX OF INHOMOGENEOUS GASES R. M. Huffaker p 39–43 (See N66-22335 11-33)

7. SOME SUFFICIENT CONDITIONS FOR MINIMAX CONTROL T. E. Carter p 47–53 (See N66-22336 11-10)

8. CONCEPTS OF THE ITERATIVE GUIDANCE LAW FOR SATURN LAUNCH VEHICLES C. D. Baker p 56–64 refs (See N66-22337 11-21)

9. DEVELOPMENT OF A LASER DOPPLER FLOWMETER FOR GAS VELOCITY MEASUREMENT W. Foreman (Brown Eng. Co.) and R. M. Huffaker p 66–71 refs (See N66-22338 11-16)

10. MEASUREMENT OF GAS TEMPERATURE AND THE RADIATION COMPENSATING THERMOCOUPLE G. E. Daniels p 72–84 refs (See N66-22339 11-14)

11. OPTICAL INTEGRATION OVER CORRELATION AREAS IN TURBULENT FLOWS F. R. Krause and M. J. Fisher (IIT Res. Inst.) p 85–87 refs (See N66-22340 11-12)

12. ELASTIC STABILITY OF A SLENDER BAR UNDER DYNAMIC LOADS F. C. Liu p 90–94 refs (See N66-22341 11-32)

13. OPTIMIZATION OF SLOSH BAFFLE GEOMETRY H. Buchanan p 95–100 refs (See N66-22342 11-32)

14. SATELLITE SHADOW TIME P. E. Dreher p 102–107 refs (See N66-22343 11-30)

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—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

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